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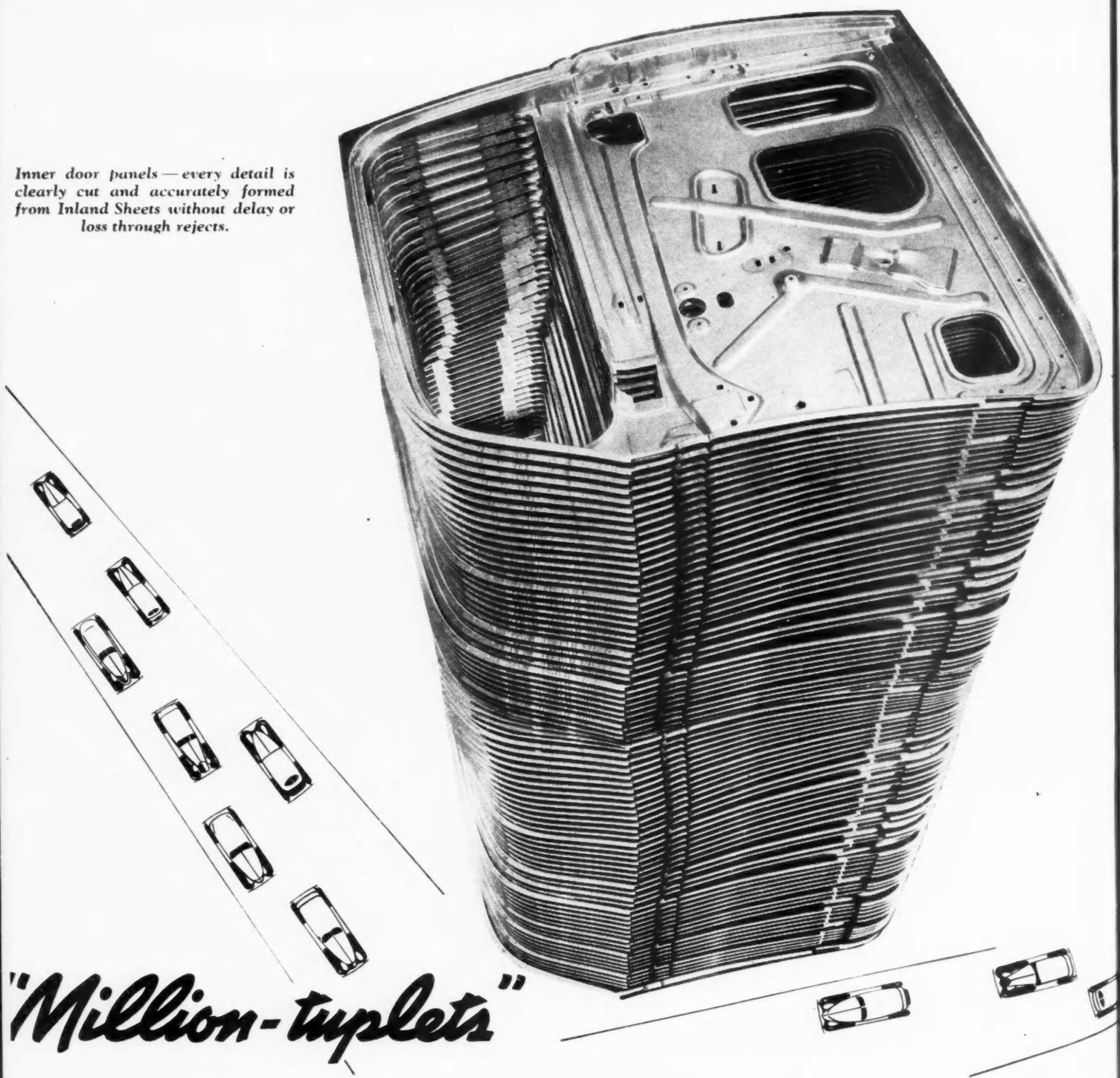

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AUTOMOTIVE INDUSTRIES

June 25, 1938
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Labor

Rival UAW Camps Maneuvering For Rank and File Support

A temporary lull that had developed in the bitter family row within the ranks of the United Automobile Workers Union was expected to give way to new fireworks as soon as formal charges had been filed by Homer Martin, president, against the five officers recently suspended.

While groups within the union were working feverishly to bring about a reconciliation without which the future of the UAW cannot be very bright, others were working just as desperately in the interests of one or the other of the two camps into which the rank and file membership has been thrown by Martin's action in suspending five officers of the union, who in turn have the support of six other members of the international executive board to bring about a 13 to 11 split of the board's membership.

While Martin was reported in the East in connection with organizing activities in the aircraft industry, UAW headquarters announced that charges against the suspended officers were being prepared and probably would be filed before the end of the current week. The suspended officers are said to have demanded immediate filing of charges.

The union's constitution provides that suspended officers must be given 15 days in which to prepare a defense after charges have been formally filed and until this action has been taken both sides are expected to continue their maneuvers for rank and file support.

Martin's administration won a victory when it secured release of the union's current funds in order to meet the current weekly payroll of $5,000 for office workers and other employes after George F. Addes, suspended secretary-treasurer whose signature had formerly been required on checks along with that of Martin, failed in his move to have the banks refuse to honor checks without his signature.

However, the per capita dues paid by various UAW locals, upon which the union depends to main-

(Turn to page 834, please)

COL. FRED GLOVER

. . . . formerly associated with the United Specialties Co., Detroit, and chief of motor transport for the United States Army during the World War, was this week announced president and general manager of the Reo Motor Car Co. to succeed Donald E. Bates who submitted his resignation at a meeting of the board of directors. Rowland Campbell, chairman of the board, is reported to hold the view that the election was not "official" inasmuch as the board meeting was attended by only four of the authorized board of nine directors.

Engine Rebuilders Hold 16th Annual Convention

Technical discussions led by factory engineers on various phases of automotive servicing, and inspection trips through Detroit automotive plants featured the 16th annual convention of the Automotive Engine Rebuilders Association in Detroit, June 20 to 23.

Prominent on the program were: "Diesel Engine Maintenance," a question and answer period led by E. A. Haskings, service director, Hercules Motors Corp., Canton, Ohio; "Engine Performance as Influenced by Spark Plugs," by R. K. Christie, engineer, Electric Auto-Lite Co., Toledo; "Modern Automobile Electrical Problems," a sound film by Packard Electric Division of General Motors; "Bearing Troubles and How to Determine the Cause," by A. B. Willi, chief engineer, Federal Mogul Corp., Detroit; "Modern Valves and Valve Seat Engineering," by A. T. Colwell, director of engineering, Thompson Products, Inc., Cleveland; "Lubrication and Its Relationship to New and Rebuilt Engine Performance," by S. B. Magille, lubrication engineer, Warren, Pa.

Production

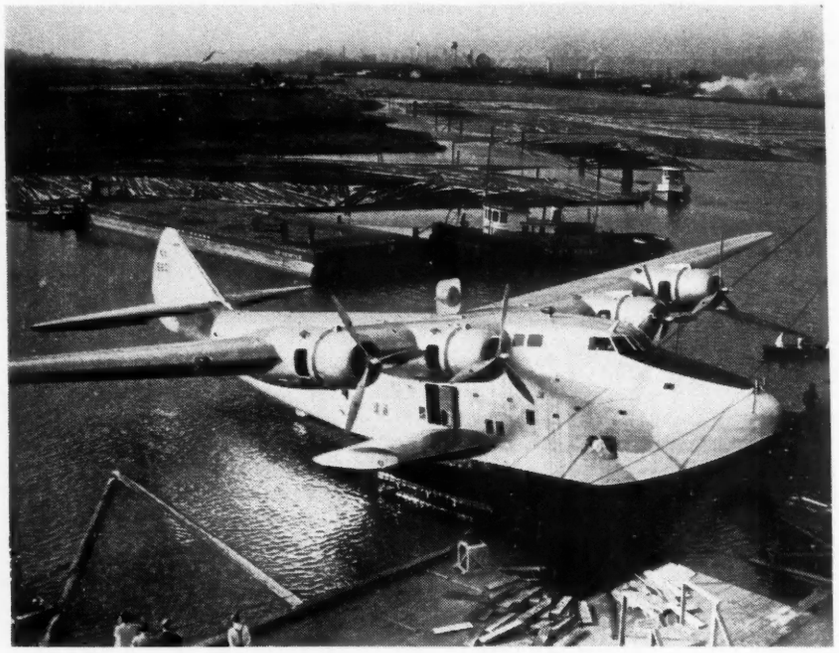
Output for June Now Estimated At 160,000 Cars and Trucks

Preliminary estimates of car and truck production during the third full week in June indicate that the industry is fully living up to statements made by leading factory executives recently that production lines would continue to operate well into the summer and that shutdowns necessitated by change-overs for new models would be no longer than the period required in other years. Furthermore, with sales showing a firmness somewhat greater than anticipated earlier in the year production also has been maintained at a constant level thus far into June with indications that this steady pace will be maintained throughout the balance of the month.

For the third successive week the industry's output of cars and trucks will finish close to the 40,000 mark, it is estimated, with actual production expected to total approximately 39,600 units. At this rate the output for the month should be fairly close to 160,000 cars and trucks.

The three major producers, General Motors, Ford and Chrysler, will again contribute the largest share of the week's total with all units of the three companies sticking to the rate in effect since the month began. General Motors, led by Chevrolet's 10,000 and Buick's 3200, will account for an estimated 16,250 cars and trucks of all divi-

(Turn to page 831, please)



BOEING'S 314 Pan American Clipper just after it was moved down the ramp at the Boeing Aircraft Co. plant in Seattle into the waters of Duwamish Waterway. The 74-passenger ocean air liner has made its maiden flight and is now in the test and adjustment stage preliminary to delivery for service. Five identical sister ships are now in various stages of construction at the Boeing factory.

Industry Within New Labor Act

Automotive Manufacturers Now Exceeding Wage and Hour Provisions of 1938 Fair Labor Standards Act

Automotive industries exceed by far the wage requirements and are well within the hours provisions of the new Fair Labor Standards Act of 1938 and, therefore, apparently will not be immediately affected by the law.

Outstanding provisions of the act are:

It established in the Department of Labor a wage and hour division under an administrator to be appointed by the President and confirmed by the Senate. The administrator can appoint industry committees for any and all interstate industries or even for units of a single industry, regardless of wages paid.

It establishes a universal minimum wage of 25c. an hour for the first year, to be increased to 30c. for the following six years and then 40c. However, a rate as high as 40c. may be recommended for immediate application at any time, after investigation by the industry committees, which will be composed equally of employer, employe and Government representatives, one of the latter to act as chairman. The committee may, but is not required to hold hearings. The administrator can reject committee recommendations.

"The committee," says the law, "shall recommend to the administrator the highest minimum wage rates for the industry which it determines, having due regard for economic and competitive conditions, will not substantially curtail employment in the industry."

The law itself, not the administrator, fixes the hours. It establishes a maximum 44-hr. week for the first year, a 42-hr. week the second year and a 40-hr. week thereafter. Overtime work is permitted if the employe is paid at a rate of not less than time and one-half.

Special provision is made for work weeks in excess of the prescribed maximum if agreed upon through collective bargaining by representatives of employes certified as bona fide by the National Labor Relations Board. Such collective contracts may provide for as much as 2000 hr. of work during any 52 consecutive weeks, or in the case of seasonal industries for work-weeks in excess of the maximum for a period of not more than 14 weeks in any calendar year. Time and one-half pay is required for overtime for work in excess of 12-hr. or for more than 56-hr. in any work-week which may be agreed upon by collective bargaining.

Fixing of geographical differentials is left to industry committees, but no minimum wage rate may be fixed "solely on a regional basis." The committee and the administrator are required to consider competitive conditions as affected by transportation, living and production costs; wages established for work of like or comparable character by collective labor agreements negotiated between employers and employes by representatives of their own choosing; wages paid for work of like or comparable character by employers who voluntarily maintain wage standards.

Upon approval of industry committee recommendations, the administrator will issue an order making the minimum wage rate binding upon the industry or classification affected. If he rejects the recommendations, the administrator is required to refer the subject again to the industry committee or to another committee for further study. The law places no limit on the number of members of each committee, two-thirds of which make a quorum. Decision requires a majority vote.

Review of administrator orders can be obtained in a Federal Circuit Court of Appeals. Petition for a review must be filed within 60 days of issuance of the order. Review by the court will be limited to questions of law. Findings of fact by the administrator, "when supported by substantial evidence, will be conclusive." The Circuit Court may allow presentation of additional evidence if the court believes it may materially affect the result of the proceedings. The procedure for court review is similar to that provided by the National Labor Relations Act.

Violators of the wage-hour act will be subject to a fine up to $10,000 or to imprisonment up to six months, or both.

The law exempts workers in retail trades, fishing, agriculture and the first processing of farm products, service trades, etc.

The administrator will receive a salary of $10,000 a year. Employes will be appointed subject to civil service laws. Members of industry committees will be paid by the Government on a per diem basis. Attorneys engaged in litigation for the administrator will be subject to the direction of the Attorney General.

Court Denies Ford Motion To Question NLRB

The Sixth Circuit Court of Appeals at Covington, Ky., last Satur-

day denied the Ford Motor Co.'s motion to subject the National Labor Relations Board to 73 questions on how the Board reached its decision in the Ford case.

At the same time the court denied a Board motion which asked that the record in the case be considered on the grounds that the Board has certified the record in its enforcement petition. The effect of the court's action was to give control of the Ford decision back to the Board with the right to set aside the order against the company.

Attorneys for the NLRB explained that since the Supreme Court is on vacation, the writs will be considered by the justices individually. The next opportunity for a Supreme Court ruling will be when the high court reconvenes in October.

U. S. New Car Registrations and Estimated Dollar Volume By Retail Price Classes

Continuing the trend upward as revealed by figures for March, U. S. new car registrations* in April passed the preceding month by 11,007 units to total 185,925.

Comparison of estimated dollar volume* figures for April and March shows an increase of $9,500,000, or approximately 6.25 per cent.

	NEW REGISTRATIONS			ESTIMATED DOLLAR VOLUME		
		Four Months			Four Months	
	April	Units	Per Cent of Total	April	Dollar Volume	Per Cent of Total
Chevrolet, Ford and Plymouth	109,980	368,973	59.48	$82,900,000	$277,700,000	51.53
Others under $1000	41,419	138,865	22.39	37,900,000	126,900,000	23.55
$1001-$1500	32,277	104,949	16.92	36,000,000	117,600,000	21.82
$1501-$2000	1,363	4,661	.75	2,300,000	8,000,000	1.48
$2001-$3000	609	2,449	.39	1,600,000	6,500,000	1.21
$3001 and over	120	450	.07	600,000	2,200,000	.41
Total	185,768	620,347	100.00	$161,300,000	$538,900,000	100.00
Miscellaneous	157	550				
Total	185,925	620,897				

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new car registrations of each model. The total dollar volumes are then consolidated by price classes. Data do not include returns from Wisconsin.

Private Motor Carriers

National Group Being Organized To Represent Operators

The Private Carriers Organizing Committee, an outgrowth of a meeting May 3 of trade association representatives concerned over national and state legislative trends affecting the operation of private motor carriers, last week named a three-man sub-committee to take initial steps for organizing a national group to more adequately represent the private operators.

R. J. O'Hare, of the International Association of Milk Dealers; J. F. Winchester, of the Standard Oil Co. of New Jersey and vice-president of the American Trucking Association's private carriers' group; and Arthur C. Butler, secretary of the Automobile Manufacturers Association's motor truck committee, were named to the sub-committee. Mr. Butler, who was given leave of absence from the AMA, was designated the organizing secretary for the committee.

"This organization will be devoted to promoting the highway transportation interests of agriculture and industry that use and employ private commercial automotive vehicles upon the American highways," the committee said at the conclusion of a four-hour session.

"This organization should be of interest to all trade, farm, traffic, purchasing, industrial and engineering organizations and other groups and individuals interested in promoting the economic use of private commercial motor vehicles. It will cooperate with existing organizations and groups having similar objectives."

The PCOC said that the combined number of privately owned and operated trucks that move the products of agriculture and industry amounts to over 3,500,000, or 85 per cent of the total number of trucks registered in the country. It explained that its plans to organize the private operators were prompted by "representatives of farm and industrial shippers, who, in recent months, have expressed the growing need for an organization to present the views of private truck owners both nationally and in the states."

Details of the committee's organization plans were not disclosed, but there were indications that if a poll of private operators indicates sufficient interest and financial support,

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SONS of Chevrolet dealers, 27 of them attending the School of Modern Merchandising and Management for sons of dealers organized by W. E. Holler, general sales manager of the Chevrolet Motor division of General Motors Sales Corp., listen to Dan Sunderland, director of the Used Car Appearance Reconditioning Institute, lecture about modern appearance reconditioning methods. The class, second of the kind to attend the Chevrolet school, is now completing a seven-weeks' course in Detroit involving study at first hand of many different phases of motor vehicle retailing. W. S. Knudsen, president of General Motors Corp. told the group last week that "We still need good retail salesmen in the automobile business . . . The most successful is the one who knows his own car, the factory behind it, and the organization of the company."

MEN OF THE INDUSTRY

JULIAN A. WESSELER, formerly sales promotion manager for Commercial Solvents Corp., has been appointed manager of anti-freeze sales.

JOHN T. BEATTY, general manager of the United Air Cleaner Division and a director of the United Specialties Corp., will sail June 26 for a six weeks' trip to England.

JOHN E. PETERS has been appointed assistant to the general manager of the Motor and Equipment Wholesalers Association.

GUSTAVE N. ERLANDSON has been named field secretary of the Motor and Equipment Wholesalers Association.

M. P. FERGUSON, formerly vice-president of the Eclipse Machine Co., Elmira, N. Y., is now vice-president and general manager of Bendix Products Corp.

LOUIS POOCK, vice-president and general manager of the Sheffield Gage Corp. and the Cimatool Co., Dayton, Ohio, was recently elected chairman of the Dayton-Cincinnati section of the Society of Automotive Engineers. Other officers were elected include: **CHARLES E. DICKERSON**, president, Miami-Dickerson Steel Co., vice-chairman, Dayton division; **K. W. STINSON**, professor of automotive engineering at Ohio State University, vice-chairman Columbus division; **W. W. TANGEMAN**, vice-president, Cincinnati Milling Machine & Cincinnati Grinders, Inc., vice-chairman, Cincinnati division; **E. S. PATCH**, engineering and sales manager, Moraine Products division of General Motors Corp., Dayton, treasurer; **WILLIAM S. WOLFRAM**, engineer, Inland Mfg. division of General Motors Corp., secretary.

C. D. MACPHERSON of the hoist and body division of Gar Wood Industries, Inc., Detroit, was recently appointed a member of the board of directors, to serve until 1940, and also placed on the executive committee of the manufacturers' division of the American Road Builders' Association, National Press Building, Washington, D. C.

Other men who constitute the executive committee are: **WILLIAM M. PARISH**, industrial sales executive, international Harvester Co., Chicago; **H. N. SCHRAMM**, president, Schramm, Inc., West Chester, Pa.; **GEORGE F. SCHLESINGER**, managing director, National Paving Brick Association, Washington, D. C.; **S. F. BEATTY**, president, Austin-Western Road Machinery Co., Aurora, Ill.; **CHARLES M. UPHAM**, engineer-director, American Road Builders' Association; **PAUL L. GRIFFITHS**, vice-president, Koppers Products Co., Pittsburgh, Pa.; and **CHAUNCEY B. SMYTHE**, vice-president, The Thew Shovel Co., Lorain, Ohio.

HARRY M. STRATTON, vice-president of the Briggs & Stration Corp., has been elected a member of the board of directors of the Missouri-Pacific railroad system.

WALTER E. SCHULTZ, of the Perfex Corp., has been elected president of the Milwaukee Association of Industrial Advertisers. **PRESCOTT C. RITCHIE**, of the Waukesha Motor Co., was elected vice-president and **JAMES TATE**, Delta Mfg. Co., treasurer and secretary.

ROBERT GRANT, general superintendent of assembly operations of the Racine factory of Nash Motors Co., has resigned to become a director and vice-president of the Fuller-Johnson Corp.

HERBERT BUCKMAN, manager of the Cleveland Automotive Trade Association since 1922, has resigned to devote all his time to his duties as manager of the Cleveland public auditorium and municipal stadium.

DR. C. F. HIRSHFIELD, chief of research of the Detroit Edison Co. and past chairman and member of the Engineers' Council for Professional Development, was recently granted the honorary degree of Doctor of Engineering by the University of Detroit.

R. H. BLACKIE has been appointed factory manager of the American Bantam Car Co.

W. E. CRAWFORD, of the A. O. Smith Corp., has been elected chairman of the Milwaukee Section, American Institute of Electrical Engineers. **FRED W. BUSH**, of the Allis-Chalmers Mfg. Co., was elected secretary.

After 18 years in purchasing and cost reduction work and many years as a director of the company, **G. B. CHILDS** resigned this month from the Buda Co. After a brief vacation, Mr. Child expects to enter other lines of work.

GEORGE B. ALLEN

. . . Dodge chief engineer, severely injured in an automobile accident on June 19. Latest bulletins from St. Joseph's Hospital, Mt. Clemens, Mich., obtained just before AUTOMOTIVE INDUSTRIES "went to press," reported that Mr. Allen's condition, although still serious, had shown some improvement.

EDWARD H. MOLL has been appointed production manager of the United American Bosch Corp., Springfield, Mass. Mr. Moll was formerly production manager of the Revere Copper and Brass Co., Detroit.

THOMAS A. ASPELL, for the past nine years general sales manager of The B. F. Goodrich Co. original equipment tire division, has been assigned to executive sales duties following an extended illness. **G. E. BRUNNER**, formerly assistant manager of original equipment tire sales, has assumed the managership of the division.

HENRY LITTLE, manufacturers sales representative, The B. F. Goodrich Co. in Indianapolis, Ind., for more than 20 years, has resigned to accept a sales position with National Safety Marker Co., Pontiac, Mich.

J. W. AUTHER, formerly of the parts and accessories department, Chevrolet Motor Co., Detroit, has joined the sales organization of Lyon Metal Products, Aurora, Ill.

GM's July-To-October Schedule Calls for 215,000 Units

General Motors schedules for new car production during the months July to October inclusive, call for the building of 215,000 cars and trucks—this includes the initial quantity of 1939 models, according to Wm. S. Knudsen, president.

The annual inventory and model change period will start at the end of June and will be staggered over the period July and August in the different plants, with all plants back in production during September, the nature of the business making it impossible to close all plants at the same time.

The plants will close on an average three weeks more than last year, which had the shortest change-over period in the history of the industry. The reason for the longer shut-down this year being caused by the severe drop in automobile sales, which was not experienced in the spring and summer of 1937.

As in former years, arrangements will be made in states which have no unemployment insurance act in force to help employes who need it.

. . . slants

RADIO ON THE ROAD—*More than 5,000,000 passenger cars on the road today are radio-equipped, according to L. G. Peed, vice-president of the DeSoto division of Chrysler Corp., who reports that the percentage of new cars being equipped with radios at the time of purchase is rising steadily.*

ROOF "TRAILERS" — *Patents are applied for on a lightweight, collapsible, portable house designed for conveyance on the roof of your automobile. It is now being fabricated by Patrick Collapsible House Co., Detroit, and will sell for less than $100.*

COLOSSAL—*A land plane, capable of flying to Europe and back without refueling, is understood to be a guarded military secret at the Douglas aircraft plant at Santa Monica, Calif. It is rumored that the new Douglas will span almost 250 ft. from wing-tip to wing-tip and weigh 160,000 lb.*

TIRE REPLACEMENT — *Oil companies, mail-order houses, chain stores and cooperatives continue to forge ahead in the tire replacement market, while independent tire dealers, department stores and tire manufacturers company-owned stores ap-*

pear to be losing ground steadily, according to a detailed breakdown of the annual tire replacement market, prepared by Dr. W. W. Leigh, University of Akron economist and statistical expert, and published in a special copyrighted article in the June issue of Tire Review.

Second Seminar of Safety Held By C.I.T.

To give impetus to workable plans for reducing traffic fatalities and injuries, Commercial Investment Trust this week held its second Seminar of Safety at the Waldorf-Astoria in New York City. Safety specialists and newspaper executives and representatives from 50 cities of 50,000 population and over, in all sections of the United States, took active part in the program which ran from June 20 to June 24, inclusive.

Drew's Highway Plan Gets Tentative PWA Support

Representative Drew's proposed super-highway connecting Washington and Jersey City has the tentative and unofficial support of the Public Works Administration, according to the Congressman who announced last week that the PWA was interested in financing the undertaking.

Production

(Continued from page 827)

sions. Ford and Lincoln are expected to deliver better than 10,000 to the total, while the Chrysler divisions led by Plymouth and Dodge should account for close to 7500. Studebaker with 1367 cars and trucks scheduled is expected to make the best showing in total production by independents.—J. A. L.

Ourselves and Government

A weekly check list of legislative, executive and judicial actions affecting the automotive industries.

CONGRESS

Seventy-fifth Congress adjourned June 16 *sine die*. All members of House and 36 Senators will face electorate in Autumn.

Passage of O'Mahoney resolution (S.J. Res. 300) set up temporary National Economic Committee of 12 members to investigate concentration of economic power—monopoly. Committee will include three senators, three representatives, one official each from Departments of Treasury, Justice, Labor and Commerce, one each from Federal Trade and Securities and Exchange Commissions. Senators appointed: O'Mahoney, Borah and King; Representatives: Sumners, Reece and Eicher. Other appointments pending, probably to be made by President. Committee has power of subpoena and $500,000 to spend. Will report to next Congress.

Signed

HIGHWAYS. Cartwright Bill to amend the Federal Aid Road Act (H.R. 10140) authorizes appropriations of $158 million for 1940 and $191 million for 1941 to continue the Federal-aid road program. Includes emergency fund of $8 million to replace bridges, etc., damaged by flood. Signed by President June 8.

Signature Pending

AIRLINES. Civil Aeronautics Act, 1938, introduced by Senator McCarran (S. 3845) creates a Civil Aeronautics Authority with broad administrative and regulatory powers over air commerce. Includes creation of Air Safety Board.

WAGES & HOURS. Originally introduced by (then) Senator Black of Alabama. (S. 2475) provides for administration by Wage and Hour Division in the Department of Labor, and appointment of Industry Committees to make recommendations for specific industries. Becomes effective in latter part of October and applies to most industries in interstate commerce. Passed by Senate and House June 14.

FEDERAL TRADE COMM.

INVESTIGATION under the Withrow-Minton Resolution (H.J. Res. 351) proceeding under direction of Dr. Francis Walker of F.T.C. to determine alleged "extent of monopolistic price-fixing and other monopolistic practices engaged in by automobile manufacturers, and alleged extent to which any anti-trust laws are being violated."

VS. GENERAL MOTORS on question of forcing dealers to purchase parts and accessories from G.M. sources only. Hearings began July, 1937.

Dealer testimony now being taken in Texas. Hearings will probably shift to New York in July for further testimony. Everett Haycraft is FTC attorney in charge.

ADVERTISING. F.T.C. cited Ford and General Motors in July, 1937, complaining of false and misleading representations in advertising prices of automobiles.

FTC has recently closed its side against General Motors after both Commission and Ford completed their testimony. GM will now present its case and has advised Commission it will not require a great deal of time.

June 29 has been selected tentatively as date for beginning GM evidence in New York. In Ford case next step is trial examiner's report to FTC, filing of final briefs by FTC and Ford, then final arguments. James M. Hammond is FTC attorney in charge.

Complaint alleges advertising 6 per cent charge on deferred payments by retail purchasers is misrepresentation because no provision is made for amortization.

F.O.B. PRICES case against General Motors and Ford. Hearings will begin after 6 per cent case is closed, probably in July or August. Hammond will be FTC attorney in charge. Complaint allege advertising of misleading f.o.b. prices because they do not include all standard equipment, etc.

FAIR TRADE PRACTICE RULES proposed for retail automobile dealers. This code, introduced at public hearing during last NADA meeting in Detroit (see A. I., April 30, 1938) still under study by FTC fair trade practice division headed by George McCorkle. Procedure: after study by fair trade practice division, rules go to full commission for approval of final draft, after which they will be promulgated and distributed to the trade. No further public hearings contemplated.

LABOR RELATIONS CASES

Ford vs. N.L.R.B.: See article p. 828.

DEPARTMENT OF JUSTICE

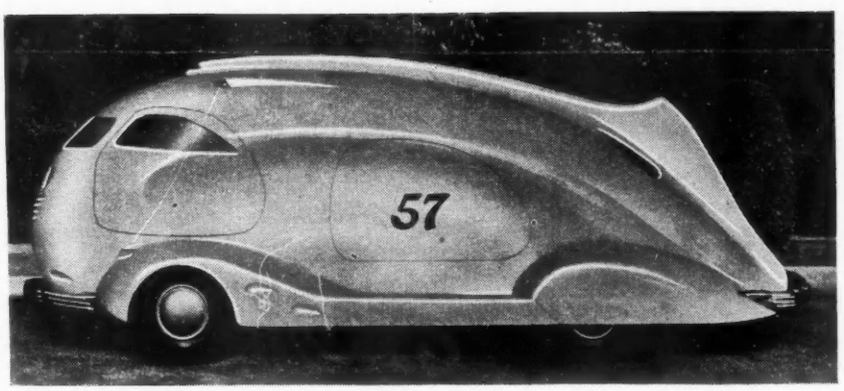
MONOPOLY. Federal Grand Jury in South Bend returned indictments May 28 against approximately 60 executives of General Motors, Ford, and Chrysler; Commercial Credit Co., Universal Credit Co., and General Motors Acceptance Corp., charging conspiracy to violate Sherman anti-trust acts. Similar case dismissed in Milwaukee by Federal Judge Geiger Dec. 17 last (see A.I.—Jan. 15, 1933. Last detail report A.I.—June 11, 1938).

WAR DEPARTMENT

Authorized by Congress to spend two million dollars in next five years for "educational orders" to industry, to facilitate industrial mobilization in time of war. See article p. 804, A. I., June 18. Signature by President pending.

MOTOR CARRIER BUREAU

On June 14 the I.C.C. issued an order postponing effect of previous order relating to maximum hours of service of motor-carrier employes from July 1 to August 1, 1938. (Ex Parte No. MC-2.)



WIND tunnel scale model of streamlined truck designed by Rust Heinz, automotive designer of Pasadena, Calif., for Autocar chassis. Several vehicles of this type are said to be under construction. When completed in about six weeks, they will become part of the truck fleet of H. J. Heinz Co., Pittsburgh, Pa. Model shown against artificial background.

Business in Brief

Written by the Guaranty Trust Co., New York

A moderate improvement occurred in general business activity last week, and several important lines showed an upturn. The business index compiled by the *Journal of Commerce* stood at 67.8, as compared with 64.5 the week before and 100.1 a year ago.

Railway freight loadings during the week ended June 11 amounted to 553,854 cars, which marks a rise of 51,230 cars above those in the preceding week, a decline of 196,664 cars below those a year ago, and a fall of 132,789 cars below 1936.

According to the *Chain Store Age*, the index of store chain sales for May stood at 103.3, as compared with 105.0 for April and 111 a year ago. Declines were greater than seasonal in all important branches.

Retail costs of food from April 12 to May 17 declined 0.4 per cent, according to the Department of Labor. Of the 84 items included in the index, 55 declined. The level of food prices last month was 8.5 per cent below that a year ago, but prices are still well above those in May, 1933.

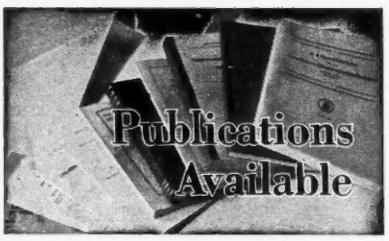
According to the Board of Governors of the Federal Reserve System, department store sales last month were 17 per cent below those in the corresponding period last year. The Board's adjusted index stood at 79 per cent of the 1923-25 average.

Production of electricity by the electric light and power industry in the United States during the week ended June 11 was 10 per cent below that in the corresponding period last year.

Lumber production during the week ended June 4 stood at 50 per cent of the 1929 weekly average. Partly as a result of the holiday, shipments and new orders were lower than for any week since April 9.

Professor Fisher's index of wholesale commodity prices for the week ended June 18 stood at 81.0, as compared with 80.7 the week before and 80.5 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended June 15 showed no changes in holdings of discounted bills, bills bought in the open market, and government securities. Money in circulation declined $17,000,000, and the monetary gold stock increased $10,000,000.



The Committee on Motor Fuels of the American Petroleum Institute has published a pamphlet, No. 1 in a Motor Fuel Facts Series, entitled **"Technical Characteristics of Alcohol-Gasoline Blends."** A foreword to the text matter states that "It is hoped that this brochure will furnish answers to the various important technical questions regarding alcohol blends and put an end to extravagant statements either for or against them."*

The Barber-Coman Co., Rockford, Ill., has published a folder giving details of its new expansible **reamer.** The company has announced that the name of the reamer has been changed from "Masterall" to "Pinwedge."*

The No. 10 Radiagraph, a new lightweight **gas cutting machine,** is described in a bulletin issued by the Air Reduction Sales Co., New York.*

The George Gorton Machine Co., Racine, Wis., has released an instruction book and parts catalog for all **pantograph machines.***

An editorial **"How Feasible Is An Annual Wage For Labor?"** by Allen W. Rucker in collaboration with N. W. Pickering, president, Farrel-Birmingham Co., Inc., Ansonia, Conn., has been issued in booklet form by Mr. Pickering's company. Single copies are free.*

"How To Fit **Eye Protection Goggles** to Worker for Greatest Comfort and Safety" is discussed in a pamphlet issue by the American Optical Co., Southbridge, Mass.*

Scully-Jones & Co., Chicago, has published its No. 400 Standard High-Production Engineering Manual. The new catalog is described by the company as a handbook of information on **production tools.**

A very interesting paper bound volume, entitled **"Relation of Fuel and Lubricants to Operating Efficiency in the Diesel Engine,"** has been published by the Texas Co.

Two bulletins, recently issued by the Engineering Extension Division of Purdue University, Lafayette, Ind., are: **"Personnel and Industrial Relations**—Proceedings of the Industrial Personnel Institute edited by J. E. Walters and R. J. Greenly," and **"Promotion of Safety on the Highways"** by Hallie Myers.

An illustrated 8-page bulletin has been issued by The Duriron Co., Dayton, Ohio, on the construction and use of two different size **heat exchangers** for corrosive liquids, such as pickling and plating solutions.

The Drop Forging Association, Cleveland, Ohio, has brought out a pamphlet setting forth the advantages claimed for **forgings** with respect to production costs and product improvement.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Private Motor Carriers

(Continued from page 829)

a voluntary group of trade association and farm group representatives would constitute the parent organization and name a paid Washington representative. His job would be to make presentations before the ICC, survey national legislative proposals affecting private carriers, cooperate with the National Highway Users Conference, and the ATA, and broadcast information to members throughout the country. State setups patterned after the Washington office would eventually be established.

In addition to those named to the sub-committee, members of the PCOC include:

Fred Brenckman, Washington representative of the National Grange; P. H. Ducker, of the Los Angeles, Calif., Automotive Council; Robert C. Hibben, of the International Association of Ice Cream Manufacturers, who was the first chairman of the committee; O. M. Kile, Washington representative of the Mail Order Association of America; F. E. Molling, of Denver, Colo., of the American National Live Stock Association; and Emory C. Rice, of Baltimore, representing the American Bakers Association. R. J. O'Hare was named chairman, succeeding Mr. Hibben.

Letters to AUTOMOTIVE INDUSTRIES

Editor, AUTOMOTIVE INDUSTRIES:

I note F. G. Clarke's suggestion that A. I. readers "may be encouraged" to give opinions on "C. R. recommendations." It is not a bad idea and it may be that, considering the times, it will be of some use to do so.

The three lower price cars, in the category of which I, perforce, do my buying, are substantially equal in price, performance and appearance. Anyone who wants to do any selecting must debate 6 vs. 8 cylinders, hydraulic vs. mechanical brakes, the sterling superiority of one of the radiator grilles over the other, or such like. The human desire for a reason, which will later justify this choice, for selecting one of these cars, simply founders on such trivialities. And yet none of these three are yet quite perfect. So what to do? Well, that's where C. R. comes in, for some people like myself, who need a mouthpiece that will reach to Detroit, maybe.

For the situation isn't right for the customer. If there is one car which is best for everybody then three competing identities have justification only during a price war. If there is no one such car then three competing identities are ridiculous. And that is the case in my opinion.

It affects me directly and definitely. If I want a 15 m.p. gal. car with cloth upholstery I can have it in three makes, half a dozen bodies and, probably, a dozen colors. If I want leather upholstery, high road clearance, greater gas mileage, shorter overall length, accessible wheels, lighter weight, or any of a half dozen other desirable variants, I can get at the most

one of these, and only in the wrong combinations with the others.

Then there is the expensive, and to me senseless, revamping of the car exterior and parts details, every year, without much performance improvement, and, as one batch of mechanical "bugs" has been discovered and removed, another takes its place. Auto makers can certainly leave some senseless exasperators in and about a car. My own car cannot have the steering gear tightened up without removing an engine side frame panel and this panel won't come off unless the steering arm is pulled. And when the car stopped, out of gas once, on a crowned road, the gallon I had wouldn't start it until I had pushed the car bodily to the other, and wrong, side of the road. The gas intake just had to be on the high side of the tank. Either of these is sufficient reason for selecting a different sample from three performance identities.

C. R. cannot at present dig very deeply of course. But if it holds up to ridicule the asininities of auto advertising, parts the hair between the sales gadgets and genuine engineering advances, and points out the bugs that get by, it can have my three dollars. And if some of its criticism seems inane or futile, don't forget that any comparison between the members of a set is defeated and made inane exactly in the degree that these members approach identity. Some day such a consumer's organization is going to have something to say about the type of cars we will buy. There can be no doubt whatever that in the attempt to "pep up" the sales argument the advertising people have overdone matters and are, in many cases, doing dis-service to the customers. Not only in the bill the consumer pays either. Of course auto advertising is not yet in the cigarette ad class.

I know that, except for the peanut shell exterior, the cars today are better than they have been. They ride, steer, and speed like angelic demons. They are very remarkable transportation. But what disease is this that glorifies the non-essentials when the fundamentals are so fine, and that stultifies all selection by adopting, without a dissident vote, the ideal of complete identity, under the sign of the peanut.

Yours truly,
CARL R. ENGLAND
Holmdel, N. J.

AUTOMOTIVE ABSTRACTS

Diesel vs. Spark-Ignition Engines in Aviation

For cruising, the Diesel has definite advantages over the carburetor engine. Although at present its service life is not as great, there is no doubt that this will be remedied. For take-off and climb at maximum speed, where engine power is of the utmost importance, the Diesel is inferior, because of its lower weight efficiency. It is to be expected that this inferiority cannot be overcome, because it is difficult for the Diesel to attain the speeds of rotation that are reached with the gasoline engine. As to relative frontal areas of the powerplants, which are important from the standpoint of maximum speed, the two types of engine are equal.

It is therefore likely that the carburetor engine will always be preferred where long trips without intermediate landing are *not* required, and especially where the take-off has to be made with heavy load, and where maximum speed is aimed at. The Diesel, on the other hand, will be preferred where long flights without intermediate landing are necessary, and where high fuel economy is of importance; especially if the flight may be made at relatively low speed and if external conditions, such as the availability of catapulting equipment or long runways facilitates the take-off.

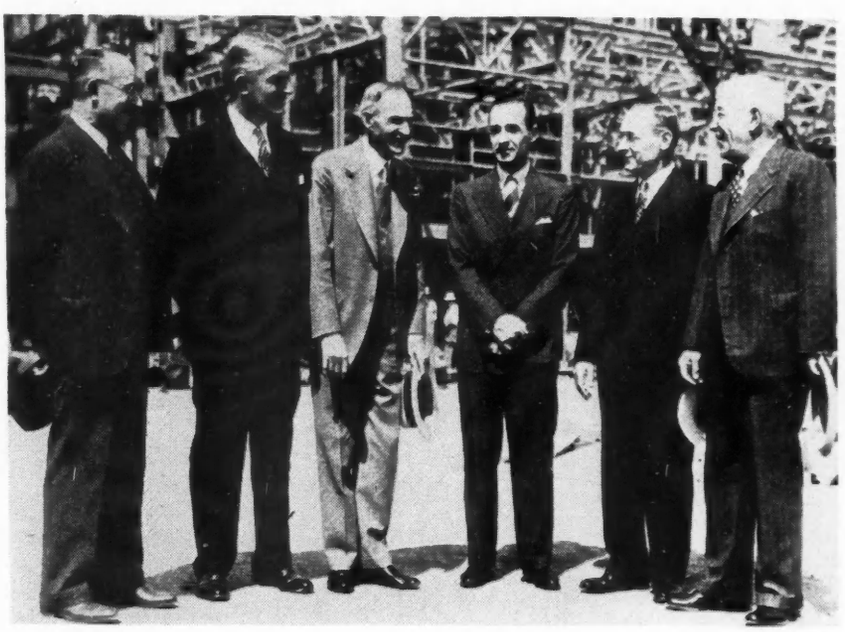
Probable weights of the powerplants for two applications of the respective kinds have been figured out. The first case is that of a ship having one or more units giving a total of 1200 hp. for the take-off and 600 hp. for cruising for 7 hrs.

	Gasoline	Diesel
Weight of engine, stripped	1036 lb.	2095 lb.
Accessories	905	880
Fuel and oil	2200	1760
Tanks (armored)	198	88
Total	4339 lb.	4823 lb.

In the foregoing the specific weight of the stripped engine, based on the take-off power, was taken as 0.86 lb. per hp. for the gasoline engine, and 1.74 lb. per hp. for the Diesel. The specific fuel consumptions figured with are 0.53 lb. per hp-hr. for the gasoline engine, and 0.42 lb. per hp-hr. for the Diesel. The figure for the gasoline engine is being obtained with current engines, while that for the Diesel is somewhat optimistic, as 1200-hp. Diesel engines are not yet in production. In spite of this, the gasoline-engine powerplant is shown to be superior. As the duration of flight contemplated is 7 hours, which with current flying speeds corresponds to a distance between 1200 and 1800 miles, the longest continental flights can be made, and it may, therefore, be concluded that for such flights the superiority of the gasoline engine has been proved.

On the other hand, for the much longer transoceanic flights the oil engine shows up to advantage. A ship intended for this purpose should have powerplants capable of delivering 2000 hp. during the take-off, and 1000 hp. in cruising for 20 hours, this corresponding to a distance of 3750 to 5000 miles. Under these con-

(Turn to page 837, please)



Acme photo

ORIGINAL employes of the Ford Motor Co. joined with the founder Henry Ford and his son, Edsel, to celebrate at Dearborn, Mich., on June sixteenth the thirty-fifth anniversary of the company. Left to right: John F. Wandersee, 1902; W. Sorenson, 1903; Henry Ford; Edsel Ford; Peter Martin, 1903; and H. G. Marburger, 1903.

Automotive Metal Markets

Slight But Steady Improvement in Automotive Buying Dispels Some Steel Market Gloom

Mildly improved buying by several automobile manufacturers and parts makers helped to put the steel market in a more cheerful frame of mind. A Michigan steel company relighted several idle furnaces to care for incoming automotive business. Some western Pennsylvania and Ohio finishing mills were able to schedule slightly better production rates for this week, chiefly so because of more satisfying accumulations of small lot orders.

Rate of ingot capacity operating this week, according to the American Iron & Steel Institute, is 28 per cent, compared with 27.1 per cent last week. While this is the third successive gain in the weekly operating rate, there is a good deal of hesitancy about interpreting it as a definite upturn in the industry's trend.

Announcement of nominally lower third quarter prices for galvanized sheets brought renewal of speculation as to possible price changes in other descriptions of steel. Galvanized sheets have for some time been sold to certain buyers at below the publicized quotations, so that the new third quarter price is virtually nothing more than recognition of the actual market. Moreover, the price of zinc has come down sharply in comparison with what it was when the old price for galvanized sheets was established. Relatively light as is the amount of zinc required to coat a ton of galvanized sheets, there has been an actual lowering in the production cost of this specialty, a condition that steel manufacturers say must precede the marking down of selling prices of other classes of steel. There continues, however, a certain amount of pressure from the outside on steel prices, such as another study of the cost of steel by one of the Government departments. Reductions in tractor prices have also come in for serious attention.

Forty-cent tin became a reality at the close of last week, when there was spirited covering by dealers and speculators in anticipation of what curtailment in exports the International Tin Committee would decree. When the committee met on Monday, its action turned out to be a cut in the export quota for the third quarter to 35 per cent of "standard" tonnages, an additional 10 per cent to be diverted to the buffer pool, which is still in the formative stage. Definite information on this development sent the price for spot Straits to 41½ cents. Consumer buying, following the advance, was impressively light. While world production of tin in the third quarter is generally predicted to dip below world consumption, there is hardly likely to ensue any actual paucity in the supply. Not only is there a good-sized reserve in warehouses or afloat, but there is also quite a little in the way of tonnage scattered among alloy manufacturers and fabricators. It is quite possible though that toward the end of the third quarter the buffer pool will begin to function as a cushion for what may look statistically like a tight fit between supply and demand. Most consumers are resigned to having to pay somewhat higher prices for tin, but if the advance is too sharp, continuity of the artificial control scheme will be seriously jeopardized.

Copper producers outside of those in the United States, also operating as an international cartel, cut production quotas from 105 per cent of theoretical capacity to 95 per cent, effective July 1. While foreign markets advanced, the price here remained unchanged at 9 cents for electrolytic. Somewhat higher prices were bid for scrap.

The statistical position of lead still favors consumers, and storage battery makers are only mildly interested in offerings. The zinc market is quiet. Somewhat better inquiry from automotive consumers is reported in the aluminum market.—W. C. H.

Kettering Appointed to Michigan State Planning Commission

C. F. Kettering, vice-president in charge of research, General Motors Corp., has been appointed to a new State Planning Commission by Governor Frank Murphy of Michigan, according to an announcement from Lansing on June 21.

The new commission, according to Murphy, will study problems of employment, education, recreation, marketing, land utilization, industrial management with the idea of pointing the way to more effective guidance of economic and social growth without interfering unduly with individual enterprise or freedom.

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40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Detroit Horseless Carriage Co.

Barton L. Peck, of the Detroit Horseless Carriage Co., Detroit, Mich., has nearly completed a gasoline carriage, propelled by a four-cylinder motor of the upright type.

The first trial, which was made at 2 o'clock in the morning, developed the breakneck speed of thirty miles an hour, necessitating a reduction in the pulleys to bring the maximum speed down to twenty miles an hour.

Mr. Peck writes that he was recently arrested for going up one of the main avenues at night at a twenty-mile pace.

From *The Horseless Age*, June, 1898.

Labor

(Continued from page 827)

tain a balance in its funds for current expenses, have become the subject of much dissension. The Martin administration claims that per capita dues payments are coming through while followers of the suspended officers claim that many of the locals have held up their per capita payments or are mailing them to the suspended secretary-treasurer until they know what is going to happen next.

The Detroit postoffice has announced that it is holding up all mail which could be identified as "official business" of the UAW and which is addressed to any of the suspended officers pending a ruling from the solicitor-general in Washington, although mail addressed personally to the suspended men is being delivered to their homes. Mail addressed to the secretary-treasurer without the name of one of the suspended officers was being delivered to UAW headquarters, although this action was believed to hold up, at least for the time being, some of the per capita payments which are being mailed.

UAW locals withholding payments of per capita dues have been warned by Martin that they face revocation of their charters, as provided in the union's constitution, which requires that these payments be made at the rate of 37½ cents

per employed member on the fifteenth of each month. The constitution also provides that in case of disputes the International may take over and supervise the affairs of locals.

In addition to Addes the suspended officers included four vice-presidents: Richard T. Frankensteen, Wyndham Mortimer, Ed Hall, and Walter N. Wells.

SAE Summer Meeting

Provocative Discussion on Lubricants Marks Final Technical Session

Although the session on lubricants at White Sulphur Springs, West Virginia, marked the closing of the Summer Meeting of the Society of Automotive Engineers, it was one of the best attended and yielded much provocative discussion. With B. E. Sibley, chief technologist, Continental Oil Co., in the chair, the session comprised two papers: "The Safe Viscosity for a Motor Car Engine Lubricant," by S. W. Sparrow, The Studebaker Corp., and "Lubrication of Special Running Gear Mechanism," by Joseph Geschelin, Detroit Technical Editor, AUTOMOTIVE INDUSTRIES.

Among the discussors of Mr. Sparrow's paper were H. R. Wolf, of General Motors Research; A. Ludlow Clayden, Sun Oil Co.; A. L. Beall, Wright Aeronautical Corp.; C. M. Larson, Sinclair Refining Co.; G. L. Neely, Standard Oil Co. of Calif. Larson pointed out that blowby is growing more serious than ever and that both sludge and dilution were on the increase. Much interest was evidenced in the results with surface-treated piston rings, Mr. Sparrow reporting that all favorable results were with rings having special surface treatment.

In discussion Geschelin's paper, H. R. Wolf brought out the point that there are too many varieties of chassis lubricants on the market today. In the interest of simplification he suggested several possibilities, including that of using engine oil for all transmissions and a stable E-P gear lubricant for all axles. Others, including G. H. Freyermuth, G. A. Round, C. M. Larson, and G. L. Neely, urged the need for simplification and an approach to universal lubricants.

Round indicated that there were too many specifications and stressed the fact that with leased service stations there was no assurance that many varieties would be carried by any dealer. He claimed that based on Socony-Vacuum figures their dealers sold only 20 barrels of SAE 70 Aviation engine oil last year. Neely reported that in California his company handled no aviation oils in the service stations and, in fact, were dispensing one universal chassis lube —a stable mild E-P material.

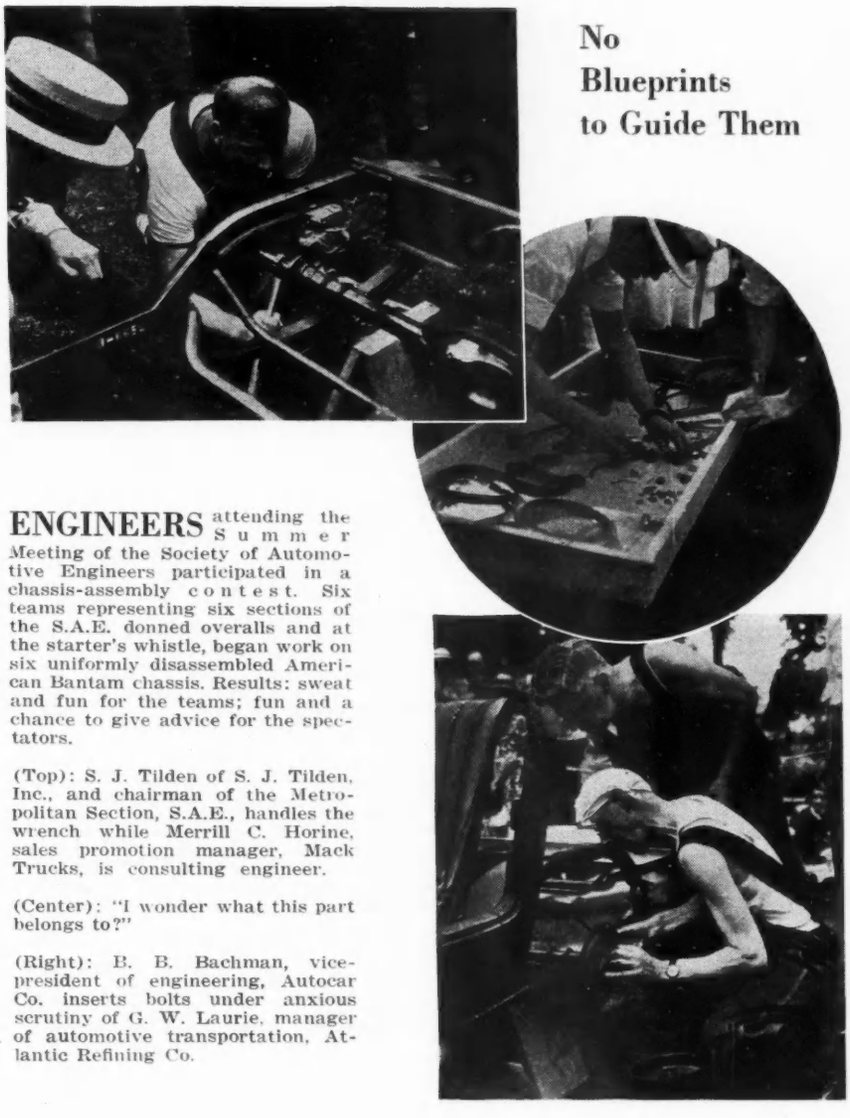
E. W. Upham, Chrysler chief metallurgist, said that in any discussion of chassis lubricant specifications, chemical stability must be considered as being of greatest importance. He indicated that the use of an approved E-P lubricant for Chrysler overdrives was recommended only to dealers. S. O. White, Warner Gear Co., chief engineer, stated that his organization was opposed to the use of any E-P materials in overdrive attachments or transmissions.

A. Ludlow Clayden, Sun Oil Co., spoke for the sub-committee on rear axle and transmission lubes, intimating that the study under discussion constitutes a very good reason for a fresh SAE project research on the subject of chassis lubricants. The problem appears to be rather involved, in his opinion, and will demand a great deal of educational effort before any widespread simplification of chassis lubricants can be adopted.

C. M. Larson advised that Sinclair already was carrying only a few types of chassis lubes in their service stations.

W. S. James, Studebaker chief engineer, struck an interesting note when he asked—What is meant by distribution? Ensuing general discussion indicated that despite the variety of specification lubricants demanded by automotive engineers, filling stations were stocking but a few types of lubes. It was intimated that this phase of the problem demands immediate attention and recognition by engineers.

No Blueprints to Guide Them



ENGINEERS attending the Summer Meeting of the Society of Automotive Engineers participated in a chassis-assembly contest. Six teams representing six sections of the S.A.E. donned overalls and at the starter's whistle, began work on six uniformly disassembled American Bantam chassis. Results: sweat and fun for the teams; fun and a chance to give advice for the spectators.

(Top): S. J. Tilden of S. J. Tilden, Inc., and chairman of the Metropolitan Section, S.A.E., handles the wrench while Merrill C. Horine, sales promotion manager, Mack Trucks, is consulting engineer.

(Center): "I wonder what this part belongs to?"

(Right): B. B. Bachman, vice-president of engineering, Autocar Co. inserts bolts under anxious scrutiny of G. W. Laurie, manager of automotive transportation, Atlantic Refining Co.

Petroleum Congress

The Third World Petroleum Congress will be held in Berlin during the spring of 1940. One of the principal subjects of the program will relate to synthetic motor fuels as manufactured in Germany. The organizing committee is headed by Dr. L. Ubbelohde of the Deutsche Gesellschaft fur Mineraloelforschung.

Le Roi Gets $170,000 Contract For Airport Lighting Plants

Le Roi Co., Milwaukee, manufacturer of industrial internal combustion engines, compressors, etc., has received contracts from the Department of Commerce valued at $170,000 for emergency lighting plants for airports.

Controls for the equipment will be furnished by Cutler-Hammer, Inc., Milwaukee, at a cost of about $50,000. The generator sets are entirely automatic and are to be installed on landing fields in various sections of the United States to furnish illumination in case regular power sources fail.

The order, it was stated, will be spread over a year or more, and while not necessitating employment of additional workers, probably will enable Le Roi, with commercial orders remaining at the present level, to continue operating eight hours a day, five days a week, indefinitely.

Canada Exempts Original Equipment Tires and Tubes From Excise Tax

Canadian business generally welcomed the Budget Speech of Finance Minister Hon. Charles Dunning, made last week in the House of Commons, Ottawa, Ont. Arising out of more than one hearing by the Tariff Board, a change is being made in the excise tax as it affects the automobile industry. One of the few budget resolutions provides for the exemption from excise tax of tires and tubes when they are original equipment of automobiles, tractors, trucks, trailers and motorcycles.

International Nickel Opens Pittsburgh Field Office

Announcement of the establishment in Pittsburgh, Pa., of a new field office for the International Nickel Co., Inc., was made this week by A. J. Wadhams, vice-president and manager of the Development and Research division of the company. The office, located in the Grant Building, is under the direction of H. V. Beasley.

TOOLS OF TOMORROW

"Streamlining" for appearance, incorporation of more and better safety features to protect workmen, and the provision of more mechanical and hydraulic operating features to reduce fatigue are among the most important design trends in machine tools, according to W. A. Hart, chief engineer, Colonial Broach Co.

"While 'Streamlining' is coming in strong in the machine tool field for appearance reasons primarily," states Mr. Hart, "the cleaning up of exteriors and provision of smoother shapes also provide definite operating advantages. Such machines are easier to keep clean and stimulate the operator psychologically to keep his tools in better condition."

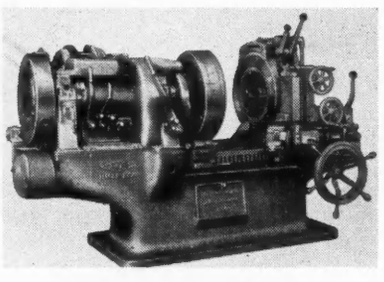
Emphasizing that floor space continues to be regarded as an important factor in the selection of machine tools, Mr. Hart points out that an important contributing factor in this respect is that machine tools occupying less floor space reduce handling of parts between operations.

Pipe Threading and Cutting

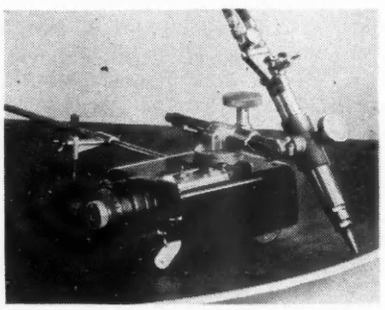
. . . Landis adds a 4¾-in. machine with receding chaser die head to its line

The Landis Machine Co., Inc., Waynesboro, Pa., has added another pipe threading and cutting machine with receding chaser die head to its line of threading equipment. This machine, identified as the Landis 4¾-in. receding chaser pipe threading and cutting machine has a capacity from 1⅝-in. O.D. to 4¾-in. O.D. It will generate a tapered pipe thread of any length up to and including 5-in., and will cut all tapers regularly used for plain pipe, and oil well casing, tubing, and drill pipe, on all sizes within its range.

The receding chaser feature of Landis pipe threading and cutting machines of this type is claimed to greatly reduce the cutting strain on the chasers, assuring maximum chaser life, accurately tapered threads, and threads of excellent finish. It is also said to permit use of a very narrow chaser which lowers the initial cost of the chasers to approximately 50 per cent of the cost of wide chasers ordinarily used for long-tapered threads.



Landis 4¾-in. pipe threading and cutting machine



Airco's latest model gas cutting machine — the No. 10 Radiagraph

Flame Cutting

. . . Airco's new portable machine will cut bevels up to 45 deg.

The Air Reduction Sales Co., New York, has added the new light-weight No. 10 Radiagraph to its line of gas cutting machines. The No. 10 will cut bevels up to 45 deg. and needs no extra attachment for this type of work. Square edges and straight lines of any length desired may be produced and complete circles up to 85-in. diameter can be cut, using a radius rod and center point. It weighs only 41 lb.

The manufacturer points out the following features of the equipment: a cutting speed of 4 to 60 in. per min. with indexed speed control for quick setting up and operation; free wheel-

ing for easy lining up to the work; simplified horizontal and vertical torch adjustment; controls positioned for maximum convenience; working parts completely enclosed; and operation on 110 volt a.c. or d.c.

ABSTRACTS

(Continued from page 833)

ditions the following probably will be the weights of engines, fuel supply, etc.:

	Gasoline	Diesel
Weight of engine, stripped	2090 lb.	2640 lb.
Fuel and oil	8380	6600
Tanks	440	330
Total	10,910 lb.	9570 lb.

The specific weight of the gasoline engine figured with in this case is 1.044 lb. per hp. This is greater than in the previous case, for the reason that the take-off extending over a longer period, it is well to figure with a lower specific output on the weight basis. For the Diesel the specific weight has been assumed to be 1.32 lb. per hp., which is less than in the previous case, and takes account of the weight advantage gained when the Diesel is being built in larger units. The specific consumptions were assumed to be 0.418 and 0.330 lb. per hp-hr. respectively, figures which will probably be readily obtained during the next few years. This comparison shows that for transoceanic flights the Diesel is definitely in the advantage. The Diesel may also prove to have the advantage when mounted in planes whose take-off is facilitated by catapults or by auxiliary planes such as the "Short Composite." In that case the inferiority of the Diesel from the weight - efficiency standpoint disappears before its superiority from the thermal-efficiency standpoint.

One possible solution in the case of multi-engined planes consists in mounting both gasoline and Diesel engines. The take-off, which would be effected with all engines running, would be rendered possible by the high weight efficiency of the former and servicing economy would be achieved by reducing the output of the gasoline engines or even shutting them down after a certain flying time.

The question naturally arises whether it is not possible to develop an engine which has the good features of both types. This idea is not entirely Utopian, for it is possible to build an engine with a compression ratio of about 10, which is equipped with a carburetor, spark plugs, and injection apparatus. For take-off it would be operated as a carburetor engine, by supplying it with a special (high-octane) fuel. While cruising, the supply of carburetor fuel and the ignition system would be shut off, the engine then being operated by injecting gas oil. With modern high-octane aviation fuels it would be possible to use a high supercharge ratio for the take-off, thus obtaining a very high output. For cruising, a compression ratio of 10 would be sufficient for an engine already in operation, and would give an interesting specific consumption.—F. Ricard, Chief Engineer of the Air Service, in *La Technique Moderne*, for June 1.

(It is difficult to see how there could be any advantage in operating on the Diesel cycle if the compression ratios were no higher than with the Otto cycle. Theoretically the consumption should be lower when operating with spark ignition, as combustion would then take place more nearly at constant volume—Editor.)

Calendar of Coming Events

CONVENTIONS AND MEETINGS

American Society for Testing Materials Meeting, Atlantic City, N. J., June 27-July 1
National Petroleum Association Meeting, Atlantic City, N. J.....Sept. 14-16
Seventh International Management Congress, Washington .....Sept. 19-23
SAE National Regional Fuel and Lubricants Meeting, Tulsa, Okla..Oct. 6-7
SAE National Aircraft Production Meeting, Los Angeles, Calif...Oct. 13-15
American Welding Society Meeting, Detroit .....Oct. 17-21
SAE Annual Dinner, New York....Nov. 14
SAE National Transportation Engineering Meeting, Commodore Hotel, New York .....Nov. 14-16
National Safety Council Meeting, Chicago .....Nov. 14-18
American Petroleum Institute Meeting, Chicago .....Nov. 14-18
National Industrial Traffic League Meeting, New York .....Nov. 17-18
SAE National Production Meeting, Nov. 30-Dec. 2
Automotive Service Industries Show, Chicago .....Dec. 5-10
*National Standard Parts Association Meeting, Chicago .....Dec. 2-3

SHOWS

New York, National Motor Truck Show, Nov. 11-17
New York, National Automobile Show, Nov. 11-18
Pittsburgh, Pa., Automobile Show, Nov. 11-18
Detroit, Mich., Automobile Show, Nov. 11-19
Columbus, Ohio, Automobile Show, Nov. 12-18
Buffalo, N. Y., Automobile Show..Nov. 12-19
Chicago, Ill., Automobile Show..Nov. 12-19
Milwaukee, Wis., Automobile Show, Nov. 12-19
Minneapolis, Minn., Automobile Show, Nov. 12-19
*Philadelphia, Pa., Automobile Show, Nov. 12-19
*San Francisco, Calif., Automobile Show .....Nov. 12-19
Los Angeles, Calif., Automobile Show, Nov. 12-20
*St. Louis, Mo., Automobile Show, Nov. 12-20
*Elmira, N. Y., Automobile Show, Nov. 14-19
New Haven, Conn., Automobile Show, Nov. 14-19
Baltimore, Md., Automobile Show, Nov. 19-26
Rochester, N. Y., Automobile Show, Nov. 19-26
Montreal, Canada, Automobile Show, Nov. 19-26
*Washington, D. C., Automobile Show, Nov. 19-26
*Cincinnati, Ohio, Automobile Show, Nov. 20-26
Newark, N. J., Automobile Show, Nov. 26-Dec. 3
Denver, Colo., Automobile Show, Dec. 5-10

*Tentative

Officers Elected by Society Of the Plastics Industry

The Society of the Plastics Industry at its annual meeting held recently at Shawnee-On-Delaware, Pa., elected the following officers for the current year: president, Allan Fritzsche, General Industries, Elyria, Ohio; vice-president, Donald Dew, Diemolding Corp., Canastota, New York; secretary-treasurer, W. L. Kelly, Chicago Molded Products Corp., Chicago. Those elected to the board of directors include: Herbert Spencer, General Plastics, Inc., North Tonawanda, New York; W. Reibold, Waterbury Button Co., Waterbury, Conn.; Spencer Palmer, Tennessee Eastman Corp., Kingsport, Tenn.; G. A. Johns, American Insulator Corp., New Freedom, Pa.

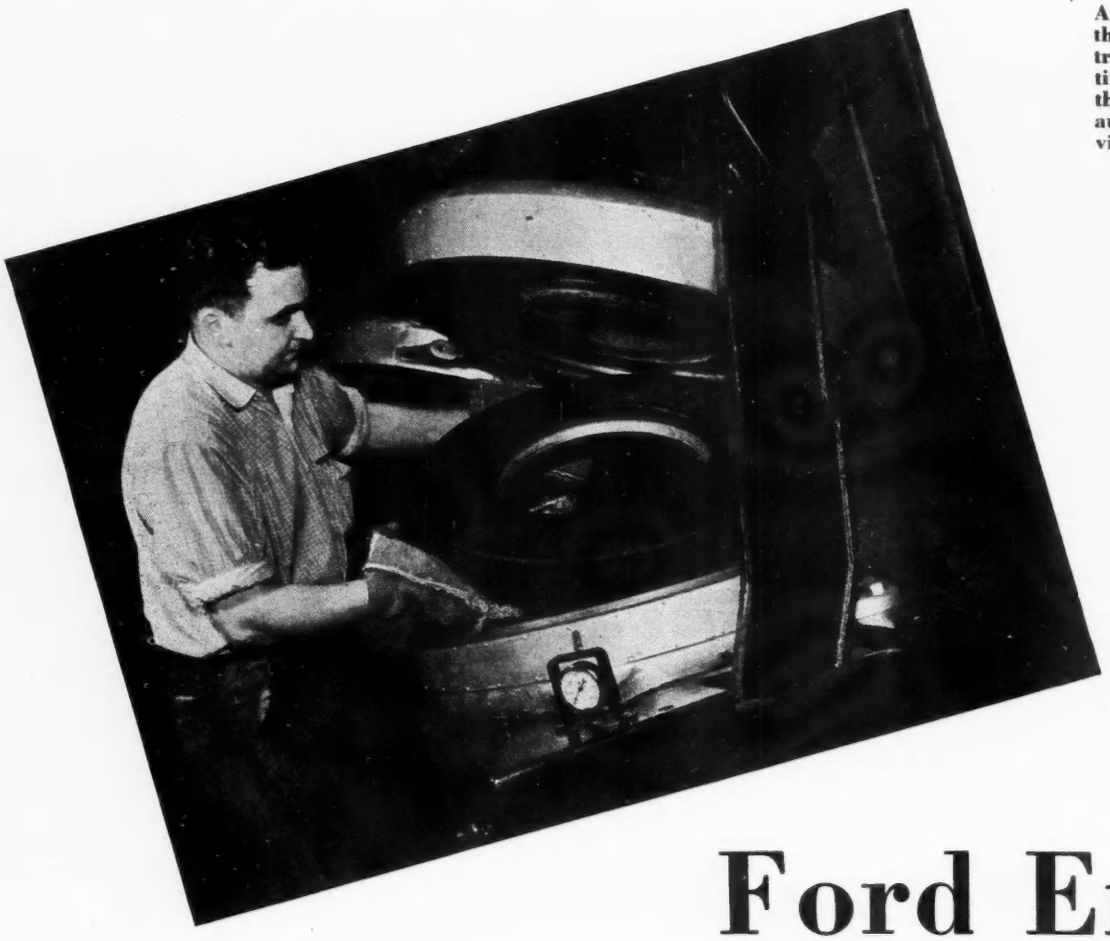
Hudson Studies Color Preferences

A color-preference study, made recently by the Hudson Motor Car Co., showed black to be the favored color in all but two of the 27 states east of the Mississippi River. The two exceptions were Florida, where black was third choice, and Alabama, where it was second.

Contrasted with this, black won first place in only two of the 21 states west of the Mississippi. Green ranked first in 11 of the western states. Tans and reds were next, being first choice in seven states and second choice in 10 others. Blues and grays shared third choice in the West. Blue, according to the Hudson survey, also accounted for a considerable percentage in the East, where grays and tans were in last place.

Goodrich Omits Quarterly Dividend

Directors of the B. F. Goodrich Co. have voted to omit the company's quarterly $1.25 per share dividend on the 5 per cent cumulative preferred stock. The preferred dividend had been resumed in September, 1936, after having been passed since July, 1931.



After 45 minutes in the curing mold, the tread design of Ford tires is formed and the tire is cured. An automatic timing device opens the mold.

Ford Enters

With the opening of the new Ford tire plant the Ford name is appearing for the first time on the sidewall of a tire. The only size being produced is the 6.00 x 16.

WITH the opening of the tire plant of the Ford Motor Co. came thoughts of the foursome of pioneers Luther Burbank, Thomas Edison, Harvey Firestone and Henry Ford. Edison and Ford cooperated in the development of a system that could use existing plants of the United States in the manufacture of rubber. Experiments were made with a number of such plants varying in type from the common milkweed to the spineless cactus, a species developed by another member of the foursome, Luther Burbank.

Much Ford money and effort have been expended in the investigation of substitutes for the present product.

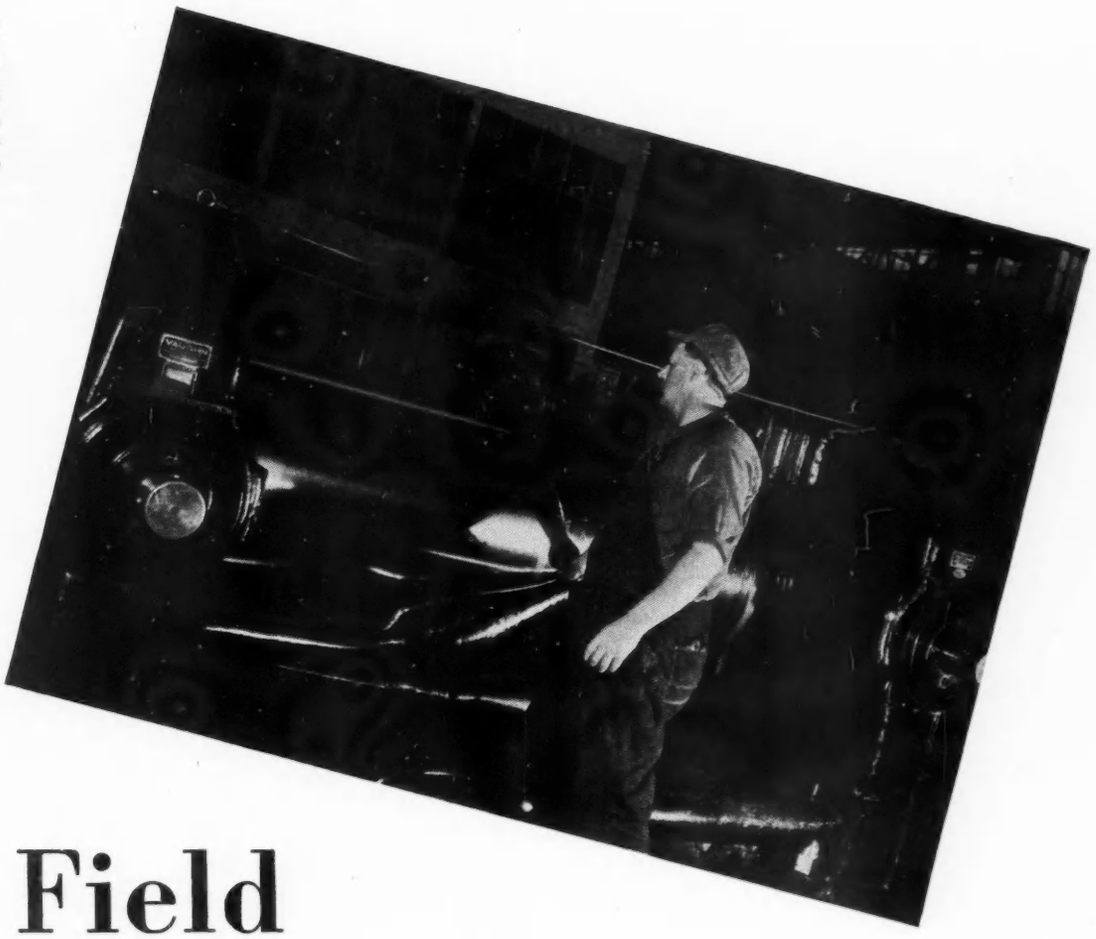
No less a venture in pioneering is the manufacturing methods and equipment evolved for this new tire plant. It is four and one-half acres tuned to produce in a new way about 4000 tires and tubes a day with an ultimate capacity of 6000 for each eight-hour shift.

Many of the methods are being used for the first time and all of the equipment has been especially designed. Even the 700,000 sq. ft. of window glass is different. The actinic rays of the sun have been found to oxidize rubber so a special filter glass is used throughout.

"In order to produce a long-wearing tire, large quantities of compounding materials, including carbon black, have to be mixed with the crude rubber which reaches us as crepe rubber or as smoked sheets," explained E. F. Wait, plant manager. "Because of the dust and dirt produced by the conventional mixing methods, the mixing department in other rubber plants is separated and not shown visitors.

"In the Ford tire plant the mixing department is a center of interest, and the visitors' walkway goes right through it. The reason is that it is spotlessly clean. This remarkable cleanliness is obtained by new methods of handling all the materials. These materials are automatically weighed and the mixing equipment is automatically operated, the materials being entirely enclosed all the way from the bins into the mixers.

"This advanced method of handling the materials has another important advantage in addition to the obvious one of cleanliness—it practically eliminates the element of human error in the important chemical



Twenty separate mills work the rubber into a plastic state, partly by heat generated by the pressure of the rubber, which may run as high as 300,000 lb. and partly by friction

Tire Field

The new Ford tire plant represents every thing that is new in tire building. All of the equipment is new in design and some of the methods used for the first time.

compounding operations. As a further safeguard against any error in the operation of the automatic weighing equipment, each batch of stock is thoroughly tested in the plant laboratory before being used in any part of the tire."

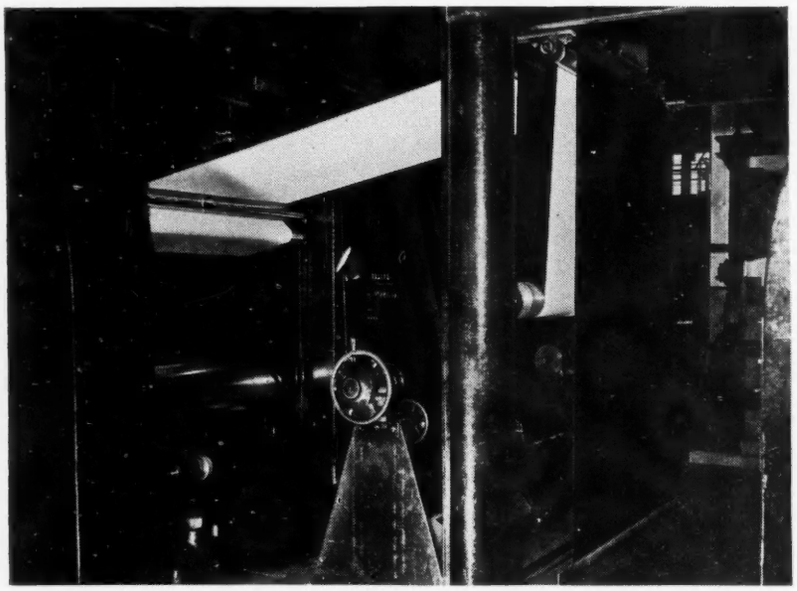
The crude rubber arrives from the plantations in bales weighing about 250 lb. These must be cut up, and the rubber heated, run through plasticators resembling huge meat grinders, and the plastic strip which emerges cut into strips before the rubber is sent on conveyors to the mixers.

The mixers themselves are enormous machines, 12 in number, driven by three 1250 hp. motors. The motors, incidentally, are operated at the powerplant voltage of 13,200 volts in order to eliminate losses produced by transforming to lower voltages.

The mixers are approximately 40 ft. high and the battery of 12 forms a row 300 ft. long. They were especially designed for the Ford tire plant to simplify the handling of the rubber stock. This was accomplished by building a "mill" below the mixing compartment. The pigments, oils and other ingredients to be combined with the rubber are fed into the mixing chambers at the proper time and in the proper amounts, the operation being controlled by an electrical monitoring mechanism. After being properly mixed, which requires approximately 15 min., the batch is dropped directly on to the rolls of the integral mill.

Rubber is incompressible, and this fact is utilized in the milling process. The mills have two rollers 84 in. long and 26 in. in diameter. These revolve in opposite directions like the rolls of a wringer, but at unequal speeds. The enormous pressure of the rubber itself, running as high as 300,000 lb., together with the friction produce the heat required to bring the rubber to a plastic condition. It is rolled thoroughly, cut into sheets and hung on racks to cool before going to the next rolling operation.

The rolls of the mills under the mixers and of the 20 separate mills used in the next step in the process of working the rubber are cooled by a continuous stream of water circulated through them. Ford engineers anticipated, however, that even this would not be sufficient during the summer to cope with the ter-



Calendering is coating the cord fabric used for tires. This view shows the cord fabric with only one side coated. Both sides will be coated and the rubber pressed into the fabric by a finishing roller.

in. long. These are rolled up for handy use for the tire builders. Breaker strip, chafer stock, bead fabric and other materials are treated and handled similarly.

The bead of the tire is built on an ingenious machine, which is largely automatic in operation. Five strands of strong, rust-resistant wire are heated and coated with rubber, and four turns of this—20 strands of wire in all, are quickly wound into a circle the size of the rim of the automobile wheel. This is covered with two layers of bead fabric, a strip of reinforced stock is lapped around it, and the bead is ready for assembling in the tire.

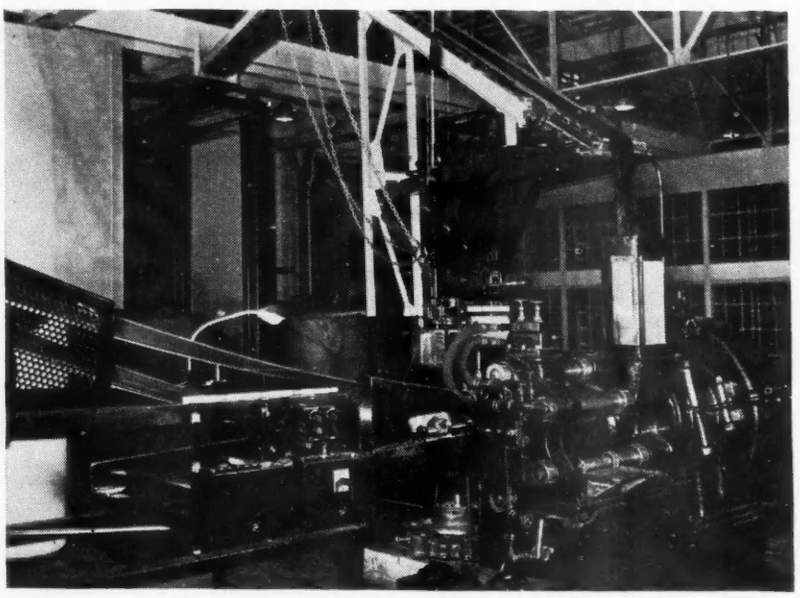
The tire is assembled on a tire building machine, the principal parts of which are a collapsible drum 16.75 in. wide and 17 in. in diameter, two wheel-like frames called bead spiders and a compensator framework to hold the fabric stock conveniently

rific heat generated by the friction of the rubber, and for that reason are preparing to install a 1400-ton refrigerating system in the plant. When this goes into operation the rolls will be cooled by refrigerated water at 56 deg. Fahr.

When the rubber to be used in making the tread has been completely milled, it is transferred in a continuous strip, cut by a pair of knives fixed to the mill, to an overhead conveyor. This takes it to the extruder, where it is forced through a steam-heated die to give it the shape desired. It then is cooled and cut automatically into individual tread lengths.

While the rubber is being rolled and re-rolled to prepare it for its trip to the tire building department, the cord fabric for the plies also is being treated. The new plant has a creel room in which 3000 spools of cord will be arranged on spindles. The cords will emerge from the room in parallel lines forming a broad sheet in which there is no cross-weave whatever. Pending completion of this department, the cord fabric is being purchased in rolls, in which there are only enough light cross threads to hold the cords in position. After treatment, the fabric moves through a drying chamber and onto reels before it is sent to the calendaring machine.

The calendering operation, which coats the cord fabric with rubber at a maximum rate of 60 yds. a min., is a continuous process in the Ford plant, and by means of an ingenious gage every inch of the fabric is weighed as it passes through the calender to make certain that it has been coated to the proper thickness. There are three sets of rolls in the calender, one to coat each side of the fabric and the third to press the rubber firmly into it. It then is cooled and wound on reels. It now has become ply stock which is cut on the bias by an automatic knife into strips 16½ in. wide and 57½



Automatic conveyors bring the rubber from the mills to this extruder machine. Here it is forced through a steam heated die to give it the desired shape

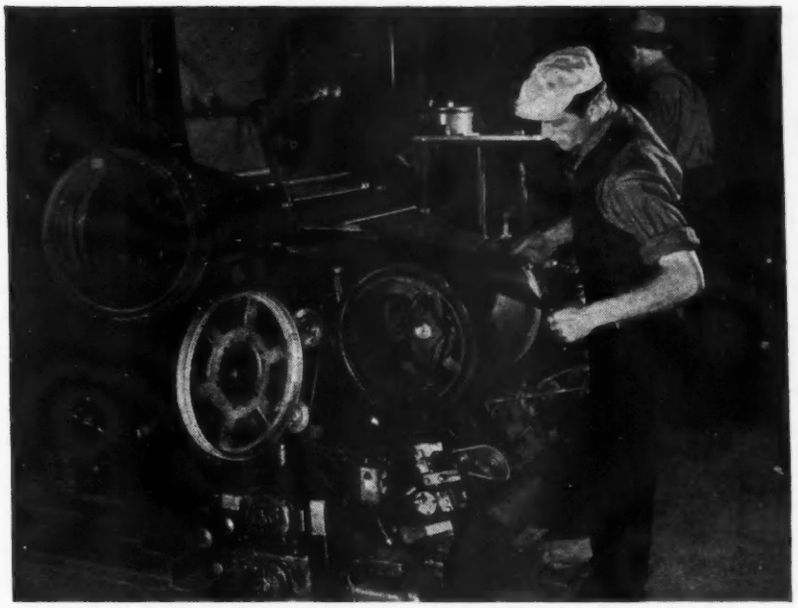
for the operator. The drum revolves and is controlled by a foot pedal. One operator assembles a complete tire.

The "green" tire as it comes off the tire-building machine does not look anything like a tire. It is a cylinder just the size of the drum on which it was built, and the visitor is at a loss to understand how it can be made large enough in diameter to take the shape of a finished tire. The explanation, however, is simple. The plies are built up of strips of

bias-cut fabric, with the direction of the bias alternating with each strip. A heavy rubber air-bag is placed inside the "green" tire in a specially built hydraulic shaper, or bagging machine. As the air bag is inflated the press comes down and the double action enlarges the tread circumference to the required size. This does not stretch the fabric, however. It acquires its larger size by the fact the cords in each layer are pulled more nearly at right angles to those in the next layer.

The shaped tire, with the air bag remaining inside, is conveyed to the curing room. Here are long rows of curing molds of new design, arranged in pairs, and automatically controlled. There is no exposed piping. Accuracy is extremely important in curing a tire properly, and the element of chance is reduced in the Ford plant to a minimum. The tire is placed in the mold by an operator, who then pushes a switch. The machine allows an interval as a safety factor, and then closes. Steam is shot into the air bag, under 180 lb. of pressure. After eight minutes the automatic mechanism turns off the steam and replaces it with 210 lb. of air. After about 45 min. in the mold the tread is formed and the tire cured. At the precisely proper minute the mold opens automatically, the tire is removed and taken to the de-bagging machine on a conveyor. The automatic control is supplied by a monitoring mechanism on the balcony of the curing room.

An interesting development in connection with the curing technique is the use of inert gas instead of air in the air bag in the second phase of the cure. The inert gas is much less destructive to the heavy rubber bag at high temperatures than is air. The Ford engineers have, therefore, developed a plan to utilize the exhaust gas from four V-8 Ford engines to provide gas for the tire curing gas. The engine gas will be purified, and the engines themselves will then compress it to 300 lb. pressure for use in the molds. In that way both the exhaust gas and the power of the engines will be utilized. The curing bags will last approximately twice as long as when they are filled with air, a worthwhile economy.



In this tire building machine the drum revolves and is controlled by a foot pedal. The separate layers of cord fabric, with the bias of each alternating, beads, breaker strip and tread stock are all assembled on this machine producing a "green" tire

Removing the heavy air bags from the tires as they come from the molds is a hot, dirty job in some tire plants, but a specially developed mechanism performs this work in the Ford plant under the guidance of an operator. This device presses the tire slightly out of round to spread the beads, inserts a blunt hook and withdraws the air bag in an operation that requires only a second or two. The tire then is cleaned and given a rigid inspection and a thorough balancing test before it is ready for shipment.

Safety is stressed at every step of the work. Driving gears are enclosed in the few cases where the engineers have not been able to work out a method to eliminate them altogether.

Wherever possible materials are moved by conveyors which reach into every part of the building.

As remarked at the outset, the plant is not entirely complete as it stands—the tube department is not yet in operation, for example, and not all the equipment is in place in the laboratory—but it is evident that enough has been done already to make it certain the new Ford plant represents a great stride forward in tire manufacturing.

In the center foreground are the "green" tires being shaped by the machines seen in the corners. The tires on the conveyors are on their way to the curing molds

Leaf Springs

Part 2 will appear in an early issue of AUTOMOTIVE INDUSTRIES

By J. H. SHOEMAKER*
Executive Secretary
Leaf Spring Institute

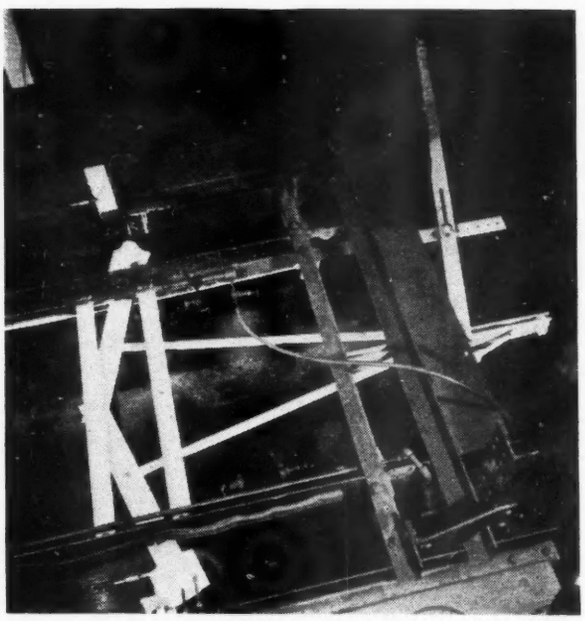


Fig. 2 — Means were provided to pass a bump under both or either of the front or rear tires

WHEN the leaf-spring manufacturers became associated under the NRA, they found that a great deal of valuable technical and manufacturing information could be exchanged, to their mutual advantage. A research and experimental program on leaf-spring independent suspensions, carried out approximately four years ago, after the introduction of competitive suspensions, emphasized the value of such cooperation.

There have been times when individual leaf-spring manufacturers have been criticized—without the opportunity to defend their position—for not having done more research and experimental work, but one who knows the facts looks at the matter in a different light. While sums of $100,000 and $200,000 were available to others for the study of riding characteristics and suspensions, the volume of business of any one leaf-spring manufacturer was not sufficient for similar effort. Also, a single manufacturer of leaf springs obviously would have to depend upon his own efforts and contacts in his research work.

With the introduction of coil springs for rear suspension on one car some months ago, leaf-spring manufacturers supplying the greater volume of springs for original equipment to car manufacturers decided to sponsor and support a cooperative investigation and program of research. It was decided to do this work jointly, sharing the expense, through an engineering committee composed of the chief engineers of five of the larger original-equipment suppliers, and their association known as the Leaf-Spring Institute. This plan offered three major advantages:

1. Many tests and the resultant expense, would not have to be duplicated.

2. Through an impartial central agency, thoughts, study and observations could be thrown into a general melting pot, from which the best and most valuable information could be selected and used.

Fig. 1—Power to drive the Belgian roll at any desired speed was provided by the car engine

* Presented before the Detroit Section Society of Automotive Engineers, May 23, 1938.

. . . . *for automotive application have been the subject of considerable research aimed at better riding qualities*

3. It was found that through such a central agency, very valuable contacts, test information, suggestions, and ideas could be obtained from both car manufacturers and suppliers of other parts affected by riding characteristics and spring suspension.

The thoughts of the spring manufacturers when this research work was started might be expressed in the words of Charles F. Kettering, when he said: "Many discoveries have been accidents, the result of stumbling on one thing while searching for another. But no one ever stumbled while he was standing still. You only stumble while you are moving. So we feel that unintelligent motion is more important in research than intelligent standing still."

Arrangements were made by the Engineering Committee for such engineering, mechanical help, and equipment as was necessary. Knowing that we must "move" to "stumble," we began by making a study of the actual riding and design characteristics of 1938 cars in large production, as they were actually being delivered to the customer. We appreciated that methods of testing riding characteristics were almost as many and varied as the number of engineers engaged in that profession.

Many conferences were held with ride and test engineers of various prominent car manufacturers, and seismographs, accelerometers, drop tests, Ride-O-Graphs, etc., were all discussed and considered, together with the various problems of interpretation and the effects of temperature changes, road conditions, varying speeds and angles. We finally decided that road conditions should be duplicated, that all variation of temperature, speed and load should be eliminated, and that the effects of road obstructions at various speeds and loads should be studied. For our recording instrument we selected the Ride-O-Graph, which is quite commonly used and generally accepted throughout the industry; but instead of allowing the wheels to drop, which is the common method of using the Ride-O-Graph, we decided to use a bump to drive the wheels and axle toward the body.

To this end we arranged for the use of the Belgian-roll equipment owned by Hupp Motor Car Co., through their cooperation and that of the Goodyear Tire & Rubber Co., in whose building this equipment was located; and that of the Packard Motor Car Co., from whom the necessary floor space was leased. Means were provided on the Belgian roll to anchor the car against forward and backward motion. Power to drive the Belgian roll at any desired speed was provided by the car engine (Fig. 1). Means were then provided to pass a bump of a given size under one or both front or rear wheels at a time. (Fig. 2.)

By a process of elimination through tests, we found that a 3¼-in. bump gave sufficient amplitude for a readable chart on the Ride-O-Graph under the conditions of our tests. We also found that there were slight differences in the results when the bump was operated by different persons, and, therefore, decided to use the same operator in all tests.

Analysis and tests showed that the most desirable information to obtain could be embodied in a chart showing the effect of a bump passing under one wheel, compared with that of a bump passing under two wheels, this effect to be measured on the front hub, the front fender, or body (Fig. 3), and the driver, who was the only occupant of the car. The three speeds found most practical for these tests were 10, 20, and 30 m.p.h. Next the effect of these same bumps on the driver in the case of a five-passenger load was determined.

Fig. 4 is typical of the charts obtained in this test. The lower graphs show the effect on the hub, of a bump passing under both front wheels, with only the driver in the car. The solid line shows the motion of the hub at 10 m.p.h.; the dotted line

Fig. 3 — Effects were measured on the driver, the hub and fender with results as shown in Figs. 4 and 5

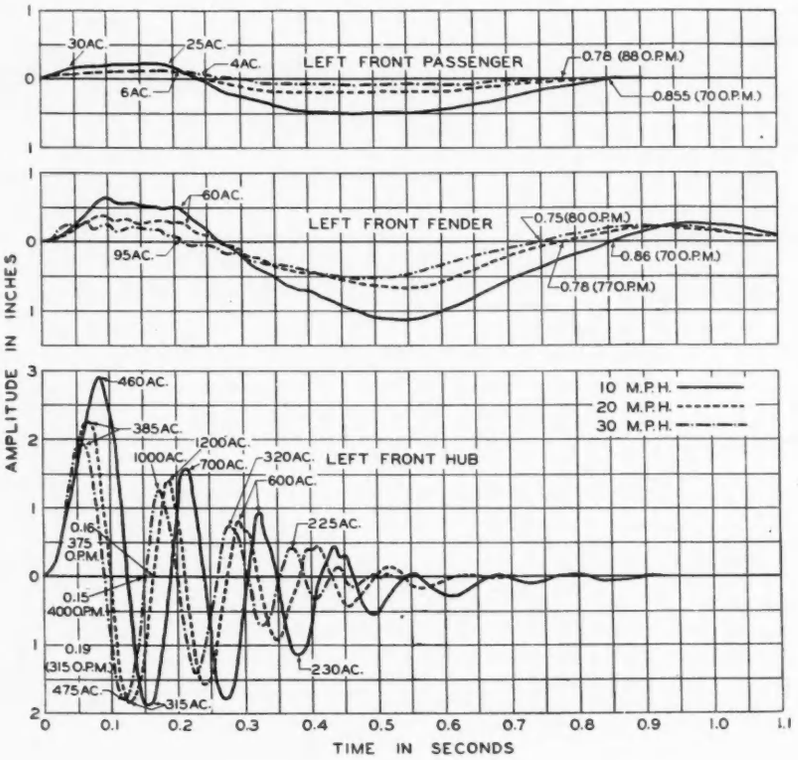


Fig. 4—(above) Effects on the driver, fender and hub of a car passing over a 3¼ in. bump

that at 20 m.p.h., and the dash-dotted line that at 30 m.p.h. The center graphs show the effects of these same bumps on the fender; the top graphs, those on the driver.

The next illustration (Fig. 5), shows a ride-o-gram of another car taken under exactly the same conditions. The difference in the results obtained from these two cars will be noted. For instance, on the first car the amplitude of the hub for the first rebound is 2.85 in., while on the second car it is only 2.50 in. However, the movements of the driver and the fender were considerably less in the first car.

Tests were also made to determine the effects under these same conditions on a single rear-seat passenger, simulating conditions in chauffeur-driven cars. The position of the car on the Belgian roll was then reversed; the same bump was used, the speeds and loads were duplicated, and the effects of rear-wheel bumps on the driver and rear-seat passenger, respectively, were determined. From this it can be seen that quite a number of tests were made on a single car, at the expense of considerable time and money. It might be well to repeat here that all tests on all cars were made under like conditions; therefore, the results from all are comparable.

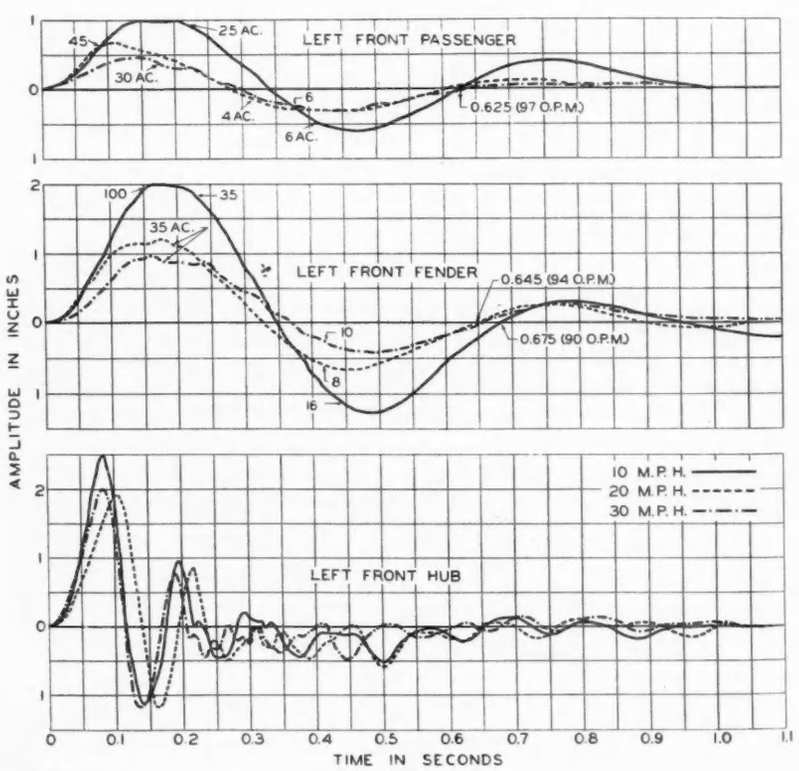
We learned that it was necessary to make a study of each car and to get a history, so to speak, of its design and construction. Therefore, a car-inspection data sheet was designed and filled out for each car tested.

The first series of tests were made on an experimental car, purchased by the Leaf Spring Institute from a leading manufacturer, whom I want to thank at this time for the engineering information, design data, blueprints, etc., which were so gladly furnished to further our research.

When we tried to obtain a second car—expecting to borrow one from a friend or dealer—the question arose as to whether the car was of standard current production and in standard condition. Therefore, we asked another leading manufacturer for the loan of an engineering car they were sure was of standard production; and here again we met with very fine cooperation. We were offered the use of a car, and one of the company's ride engineers attended the tests, all of which proved to be of inestimable value.

Therefore, we adopted the practice of contacting the head of the engineering department of each company whose car we tested, explaining to him the nature of our tests, and our desire to obtain statistical and research information that we hoped would contribute toward a better understanding of the ride problem, to the ultimate advantage of the entire automotive industry.

Fig. 5—(below) The same test as made with the results as shown in Fig. 4 but in this case with a different car



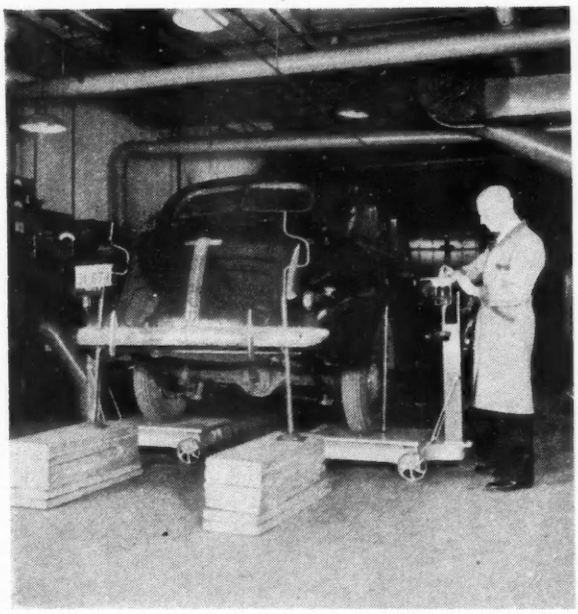


Fig. 6 — A scale was placed under each wheel to measure the maximum load

through this cooperative activity we might be able to find a general trend, or facts that might show changed conditions that would allow us to use old facts perhaps in new ways, or discover new facts that might help our objective.

After gaining experience in the operation of the test apparatus, we found that the dynamic tests on a car could be completed in one day. The second day on each car was used for a series of static tests.

Determinations of the rate of the springs were made on the car, so that we might obtain exact information of what results were being secured from the springs once they were actually functioning on the automobile.

As our work progressed, these rate tests proved of great value to us in our comparative analysis. The method of taking these rate tests was very simple.

Referring to Fig. 6 we placed a scale under each wheel, then loaded the car to obtain the desired maximum load on the springs, placed jacks under the bumper, raised the car 1 in. at a time, and each time measured the height of an indicated point on each fender, and took the weight on each scale.

As shown in Fig. 7, roll tests were made to determine the degree of roll on a given car, although this was not done on all cars. The roll tests consisted in placing scales under all four wheels and providing a pair of jacks to pull down on one side of the car, while another pair of jacks lifted up on the opposite side. An

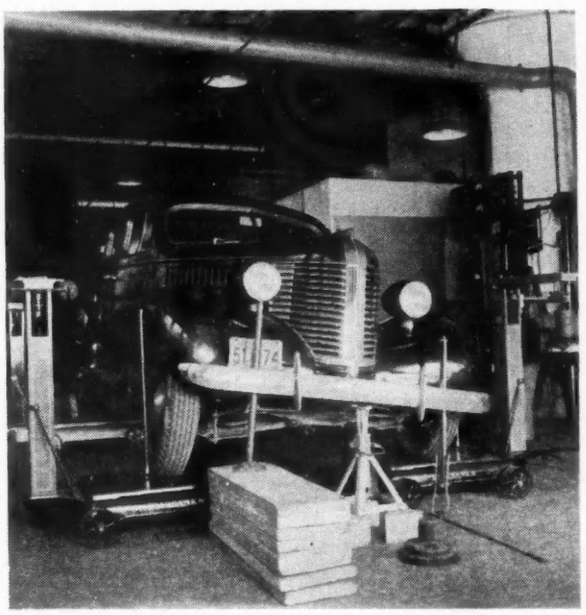


Fig. 7—Roll tests were made to determine the degree of roll on a given car

I am happy to say that every car manufacturer whom we contacted gave us the same splendid cooperation, provided us with a standard car, and delegated one or more of their engineering staff to collaborate with us. We also wish to commend the many manufacturers of parts who so generously gave of their engineering skill and experience to assist us, among them manufacturers of tires, shock absorbers, steering apparatus, shackles, bushings, spring covers, liners, and mechanical rubber goods.

We had the advantage of actual contact with more than 60 engineers actively devoting their time to riding problems, including more than 40 in the employ of the major motor car manufacturers. We felt that

Fig. 8 — Oscillation tests were made at front and rear for curb, one-passenger and five-passenger weight

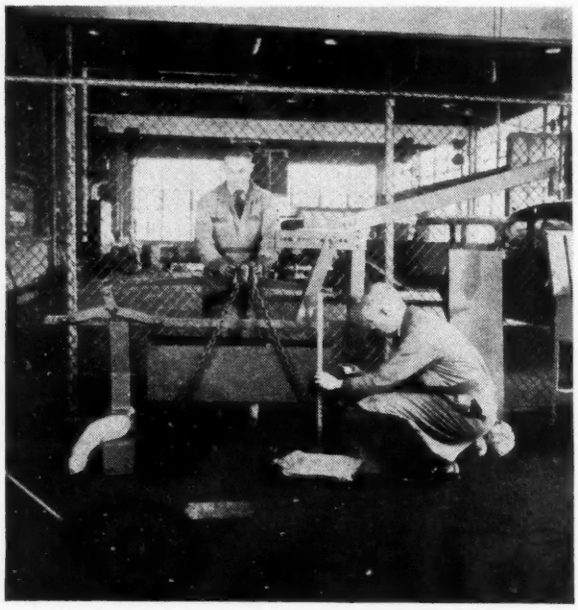


Fig. 9 — Oscillations per minute were measured on an easily adapted machine made for this test

indicator (or pivot) point was maintained by means of a feeler at the center of the front and rear bumpers.

We also made comparative tests on the effect on brake wrap-up, though these were not made on all cars. A Y-shaped lever of spring steel was fastened to the spring seats and projected to the rear of the car, where a hydraulic jack was placed on a scale. Force was then applied to the lever, causing the axle to twist in the same manner as when the brakes are applied. The angle of twist and the force applied were noted, and comparisons made.

Oscillation tests (Fig. 8) were made at front and rear for curb weight, one-passenger weight, and five-passenger weight. These tests were made with and without shock absorbers, roll bars, transverse bars, and torque arms. After making oscillation tests in various ways, and finding that there was no apparent standard or universally accepted way, we adopted a standard practical way for our own use, and all oscillation tests were made in this way, which again made the results comparable.

The third day with any given car we made road tests for our own information only, to help us to interpret, if possible, the facts regarding the ride of the car which we had found in our laboratory tests. The same course was used for each test. Observations were made at high speeds and moderate speeds, on rough roads, boulevards, and washboard formations, and the stability and roll were also determined.

After several hundred dynamic tests, and after we began to gain in experience and acquired technique, we observed that we were able to tell from the static measurements of the car approximately what results we would get in the dynamic tests. As these findings had served their purpose, and had started our thoughts along what we considered a constructive line; and as the time and cost were becoming a factor, dynamic tests were discontinued after we had tested and obtained comparative data on the seven general types of spring suspension in common use, as follows:

Coil springs front — standard leaf springs rear.

Conventional leaf springs front and rear.

Coil springs front—leaf springs rear, with rubber and metal damping inserts.

Coil springs front and rear.

Coil springs front—leaf springs rear, with grooved steel and constant-friction liners.

Planar leaf springs front—conventional leaf springs rear.

Transverse leaf springs front and rear.

One important discovery we made was that in our search for new facts we often overlook the value of old ones. All of our tests brought out very emphatically that all cars, regardless of make or type of spring suspension, rode better when fully loaded than with only one passenger. This was no new discovery—we all knew it.

Observations and questioning brought out that at least 75 per cent of our driving is done with a driver load only. Opinions regarding the percentage may differ, but all will agree that at least many miles are traveled without the four- or five-passenger ride, which is so much superior in all of our present cars.

Study of the results of our comparative tests emphasized the following facts, which are also known to all:

First—That riding comfort is fundamentally a function of oscillations per minute of the spring (or its softness).

Second—That stability (resistance to roll, bottoming and brake wrap-up) is fundamentally a function of rate per inch deflection of the spring, or its stiffness.

Since these two desired results,

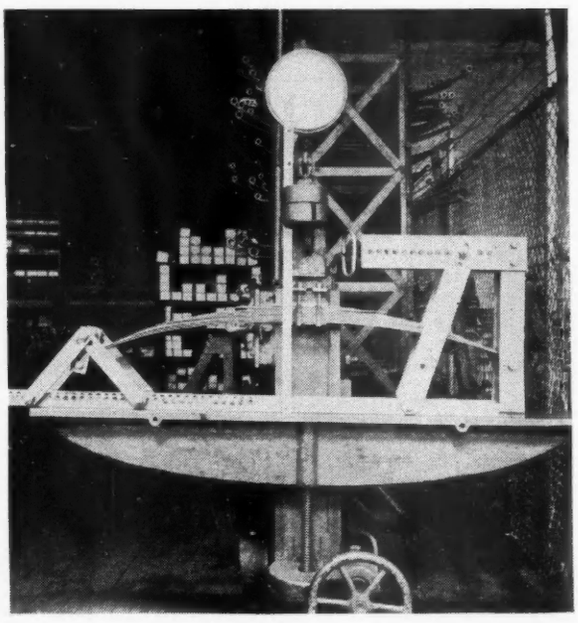


Fig. 10—The entire base of the oscilating test machine could be transferred to an Olsen test machine

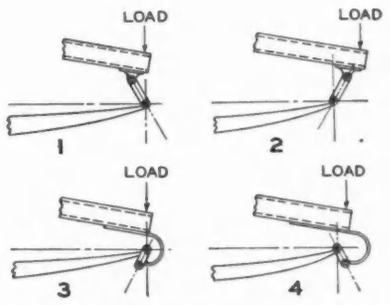


Fig. 11—Shackles may be either of the compression type (1 and 2) or the tension type (3 and 4) and each type may subject the main leaf to compression (1 and 3) or tension (2 and 4)

"softness" and "stiffness," were contradictory, our problem was to find a method of securing both without (1) interfering with present design or manufacturing practice, and (2) without any measurable increase in cost or weight of the system.

A new consciousness of oscillations per minute (O.P.M.) inspired our building a simple, easily adaptable oscillation test machine (Fig. 9). The load was hung directly on the clamped spring seat. Weights to make up any given load were deposited in a metal box hung on chains. Amplitudes were read off on a simple scale, and the spring was timed with a stop watch as it was oscillated at its natural frequency. The machine was easily adjusted for various spring lengths, and any desired length or angle of shackle; either a tension or compression shackle could be used.

The entire base of the oscillating test machine could be transferred to a Tinius Olsen test machine (Fig. 10), and data for rate curves obtained with exactly the same shackle angles, lengths, bushings, etc., so that rate and oscillating tests were made under identical conditions.

It may be well to explain here our nomenclature with reference to shackles (Fig. 11):

1. A "compression shackle" is one which the load tends to buckle.

2. A "compression shackle" may put the main leaf under tension, as at 1, or under compression, as at 2 (though this latter arrangement is not practical on automotive vehicles).

3. A "tension shackle" is one which the load tends to stretch (3).

4. A "tension shackle" may put the main leaf either under compression (3) or under tension (4).

Development work on the variable-rate spring has directed our attention also to the subject of thinner main leaves. This, in turn, has brought to the fore the subject of eye strength, a limiting factor in using thin main leaves for automobile chassis springs.

During the past few months several ideas have been worked on (Fig. 12), among them:

1. The wrapped eye, which has been used in quantity production—a. With a full wrap and split second leaf. b. A half wrap with solid second leaf.

2. A ribbed eye construction, adopted by one major car manufacturer for 1939 production, which seems to present considerable possibilities.

3. Welding of eyes which in experimental work has shown considerable promise, because of the uniformity of structure and grain of present alloy spring steels and the advance in welding technique. Both General Electric and Lincoln Electric Co. have done considerable work with us in this experimentation, as have some metallurgists.

4. Another promising type of eye construction is of "scroll" type, consisting of about one and one-quarter turns. A hole is pressed in the scroll and a nib pressed from the outside section of the eye through to this hole, thus anchoring the eye in all directions.

While we are fully conscious of the importance and possibilities of the work that is being done along the lines of providing predetermined constant friction and damping with leaf springs, our time and facilities did not permit us to go into this broad subject.

Many test data on this subject, and the results of broad experience, were made available to us, which we gratefully acknowledge. We are glad to say that our findings appear to make some of this work even more effective.

We would like to comment on the following five factors:

1. *Shock Absorbers* — Shock-absorber engineers advise us that with practically uniform O.P.M., despite varying loads, restoring force lessens the need for resistance to rebound, with two resultant advantages — better riding qualities and longer shock-absorber life.

An increased resistance to compression and bottoming in the spring lessens the need for compression resistance in the shock absorber, with two very important results, viz., a better boulevard ride at all times, and a much better ride in cold weather when the shock absorber liquid thickens.

2. *Spring Covers*—There is a considerable demand for spring covers on the part of the public and some car manufacturers. The installation of covers is entirely practical with our suggested designs, and the functioning of the spring is definitely not interfered with.

3. *Damping*—While we have not built any springs of our suggested design with rubber inserts and damping inserts, as described by Mr. Paton in his recent S.A.E. paper, we see no reason why our ideas cannot be practically combined, with interesting results.

4. *Grooved Steel Leaves*—There is no question but that all of the advantages of the grooved steel section can be used in the suggested designs, and in our opinion the many variations which now appear possible should make this development one worthy of careful study.

5. *Constant-Friction Liners*—This very interesting subject has received considerable attention in our test work, and the suggested design of spring obviously presents no obstacles to the use of present-type liners.

All of our tests and observations point to the well known fact that, other things being equal, riding comfort is fundamentally improved by a reduction in the number of oscillations per minute, resulting in relatively slow accelerations and decelerations.

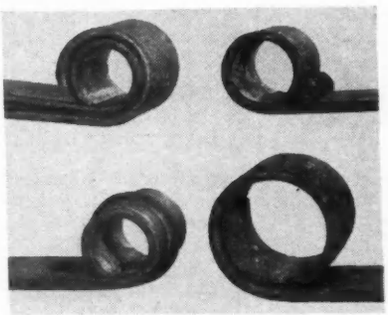


Fig. 12 — Various designs of spring eye for springs composed of thin leaves

Practically all available information on the subject of shackles refers to the rate per inch deflection of the spring, and research work should take nothing for granted. As previously mentioned, we were also concerned with the effects of shackles on oscillations per minute, and because little data on this was at hand, at least for our use, we found it necessary to make our own tests. The results, which proved most astonishing to us, will be covered in detail in a separate article to be published in an early issue of AUTOMOTIVE INDUSTRIES.

Injection of Diesel Fuel Into Flame Cuts Ignition Lag Only Moderately

By Dr. P. H. Schweitzer,
The Pennsylvania State College

An investigation was made recently in the Diesel laboratory of The Pennsylvania State College to determine whether fuel droplets injected into flame have an ignition lag close to zero, as is frequently supposed.

A 3¼ x 4½-in., 900-r.p.m. swirl chamber engine was used in the experiments, with a compression ratio of 15.8 to 1. Two completely independent injection pumps and nozzles were employed. The identical fuel pumps (Bosch PEIB50A302/3S97) had a 5-mm. plunger diameter and a 10-mm. stroke. They were driven from a common shaft, and both had independent injection-timing control. The nozzles (Bosch DN30S3) were also identical, and both were mounted in the swirl chamber as shown in Fig. 1. An electromagnetic pickup was mounted in the chamber to indicate the cylinder pressures by means of a cathode-ray oscillograph. Needle-valve lifts were recorded by mounting pickups on the valve stem of both spray nozzles. Pressure and needle-lift records were traced from the screen of a Standard-Sunbury cathode-ray indicator, which also permitted throwing a timed degree scale on the screen for reference.

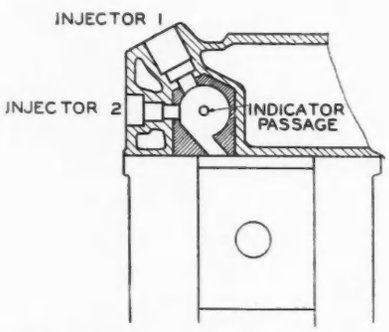


Fig. 1—Arrangement of injectors and indicator in double injection tests

Fig. 2 shows an oscillogram typical of the one hundred or so taken. In our tests, zero ignition lag was never observed. The fact that the second injection took place into flame reduced the ignition lag only by, at most, 35 per cent. It is probable that the observed ignition lag for the spray injected into flame produced by the first ignition was not shorter than it would have been if injected into heated dense air of correspondingly high pressure and temperature.

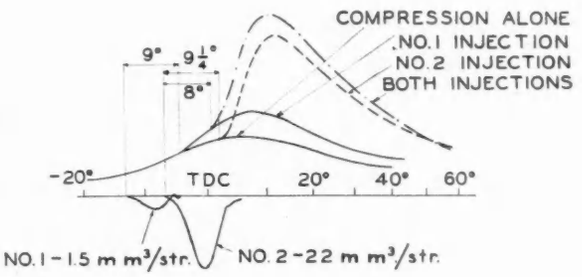


Fig. 2 — Typical oscillogram of double injection valve needle lift (below zero line) and cylinder pressures

The shortest ignition lag measured for the second spray was 6 deg. of crank angle, which at 900 r.p.m. corresponds to 0.0011 seconds (see Fig. 3). This is far from zero, and is even longer than the shortest ignition lag the author has measured for a single spray. For pure cetane at a compression ratio of 24 to 1, an intake-air temperature of 200 deg. Fahr., and 9 in. of mercury supercharge, an ignition lag of 0.00089 sec. was obtained (4.8 deg.), which probably can be considered as close to the asymptotic limit as the ignition lag can attain under any circumstances.

The reason for this belief is that in this extreme region the ignition-lag curve flattens out so that changes in compression ratio, intake-air temperature and supercharge cease to influence the lag.

Now we have evidence that this absolute minimum of roughly one millisecond holds also when injection takes place into an already burning mass. The inference is that in normal ignition, not only the first fuel droplets are delayed by an ignition lag, but all subsequent droplets as well, even the last.

The ignition lag, i.e., the time elapsed between the beginning of fuel injection and the beginning of appreciable pressure rise, can be subdivided into the physical lag and the chemical lag. The physical lag consists of the time required to heat up the fuel droplet to the temperature of the surrounding air and vaporize it. The chemical lag is the period required by the pre-flame reactions to reach flame conditions accompanied by appreciable pressure rise. The physical and chemical delays overlap somewhat, but they must be considered as two separate phenomena. According to the estimate of Boerlage and Broeze, the physical delay is between 5 and 10 per cent of

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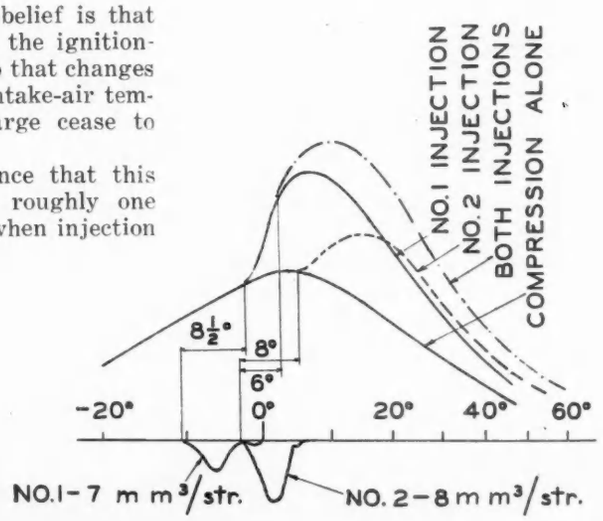

Fig. 3 — Oscillogram of double injection showing short ignition lag for the second spray

Just Among Ourselves

Moot Questions to the Front

NEXT week the Pennsylvania Automotive Association, primarily a dealer group, will hold its annual convention at Bedford Springs, Pa. That in itself is not particularly hot news. Neither is the fact that the resolutions committee of the association will present a report. But the subjects which the resolutions committee has been studying —and studying seriously — give a pretty fair indication of what automobile dealers all over the United States are concerned about. Because of this we think it is worth taking some time to put them into the record. What final form the resolutions will take is a matter between the committee and the association and we don't pretend to know how it will turn out. What is offered here is a brief statement of what the resolutions will be about.

First on the list is the subject of closed territories for dealers. Mooching between territories has concerned many of the better dealers for a long time and there will probably be forthcoming a pretty strong statement on its evils and a plea to manufacturers to extend the closed territory experiments now being conducted by one or two companies. Corollary to this will be a re-statement of the claim of the "quality" dealer to be protected from a harassing host of "fringe" dealers who nibble at his volume without making much money for themselves. There will be talk once more of limiting distributors, direct dealers and associate or sub-dealers in trading areas, a subject, you will remember, which was discussed by Alfred P. Sloan, chairman of General Motors, at the last convention of the National Automobile Dealers' Association. Mr. Sloan views a future in which the number of distribution outlets will be tailored to the territory after a scientific study of potential sales for the territory.

Automobile dealers in Pennsylvania are concerned with competition from independent used-car dealers and from finance companies selling repossessed cars. It is difficult to see what the factories can do about that, but it will be discussed at the convention and a statement of policy may come out of the discussion.

Other positive attitudes will be discussed under the heading of "clean-up protection," "contract reform" and protection against sudden death otherwise known as "contract cancellation." Most dealers are pleased, undoubtedly with recent contract reforms instituted by General Motors and Chrysler and the easing of pressure through field men by other companies. But it must be remembered that some of the grievances on these subjects are of long standing and that recent opportunities to express them before a Congressional committee, the Federal Trade Commission, and the Dealer Relations Board of General Motors have probably not exhausted everything articulate dealers have to say on the subject.

Increased discounts and used-car junking plans will be discussed close together on the program because of their intimate connection. Both are panaceas of doubtful economic validity. Each, possibly, would have about the same effect on the dealers' trading of used cars.

Most of the other things which may become the subject of P.A.A. resolutions are of more or less local interest except the question of coercion by factories in the sale of parts and accessories. Significantly it is proffered by the P.A.A. as a subject which will be brought to the floor if enough requests are made prior to the convention. Maybe there isn't as much interest in this subject as the Federal Trade Commission appears to think there is.

Bids for the Deserted Market

THE July issue of *Fortune* turns to "Willys-Overland." "Out of a grandiose bankruptcy," says the headline of the story, "and a slick reorganization emerges an economy car. It underbids Henry Ford and plays for a customer he deserted." It's a very interesting chronicle, and like many another *Fortune* story stimulates thought in many related directions.

One of the things it brings up is the possibility that some other manufacturers are planning to enter the low-price market that Mr. Ford "deserted." In one case it's darned near a certainty unless there is a considerable pick-up in the sale of normally priced cars within the remainder of the year.

Mr. Sloan and this writer and a number of outside observers, including a great many brokers in Wall Street, share the conviction that there will be no startling upturn for a long time to come. So maybe it would be a good idea to polish your spectacles in anticipation of a good look at the first of the "transportation" cars to come off the lines.

—HERBERT HOSKING.

Essentials

of papers presented at the SAE Summer Meeting on . . . . . .

A REPORT on work done with a view to developing a method of rating aviation fuels in full-scale aircraft engines was presented by H. K. Cummings of the National Bureau of Standards. This report followed one made by C. B. Veal, secretary of the C.F.R. Committee, two years ago, in which the following items of further work were listed:

"(1) Establish the validity of the C.F.R. recommended procedure for rating fuels in full-scale aircraft engines for fuels above 87 octane number.

"(2) Conduct full-scale engine tests in the range from 87 octane number to the highest octane number available.

"(3) Concurrently with item (1), develop or revise knock-test methods leading to correlation with full-scale engine data."

In Mr. Cummings' report were given data obtained in accordance with assignments (1) and (2), and conclusions based thereon. Since the first report was made, the National Research Council of Canada has become a cooperative member of the C.F.R., and it furnished some test data. The National Research Council of Canada lacked equipment for making tests with fuels of higher than 87-octane fuel, and its tests were made with the same grades of fuel as the tests covered in the first report. Its results obtained on a 14-cylinder double-row radial Armstrong-Siddeley Jagnar engine, were in substantial agreement with the results given in the first C.F.R. report on this subject. In the later American tests, made with two single-row nine-cylinder radial Wright Cyclone and a double-row radial Pratt & Whitney Wasp engine, fuels of higher octane rating were used. The following conclusions were drawn from these tests:

Unleaded isooctane blends of 84 A.S.T.M. octane number or more will be lower in full-scale knock rating than leaded blends of equal A.S.T.M. octane number containing in excess of 2 cc. of tetraethyl lead per gallon; thus unleaded blends should be regarded with caution for full-scale service.

Benzol blends will not generally be equal in full-scale knock-rating to leaded blends of equal A.S.T.M. octane number when this number is in excess of 84. However, when benzol blends of 84 or more octane number are compared with isooctane blends of equal A.S.T.M. octane number, they will on the average be higher and rarely lower in full-scale rating. The behavior of high-octane-number benzol blends in full-scale engines depends greatly on engine type and operating conditions. However, any revised knock-test method should not be more severe on aromatic blends than the A.S.T.M. method. The deficiencies of the A.S.T.M. method in respect to leaded fuels should be investigated further by tests of fuels of equal A.S.T.M. octane number and varying lead content.

A program of further work along this line was given in the paper.

Two-Cycle Diesel Engines

IN order to compete successfully with the gasoline engine, the Diesel engine must compare favorably with it as regards size, weight, performance, and cost. There are real savings only when the cost of the fuel consumed is a considerable proportion of the total operating cost —said F. G. Shoemaker, Detroit Diesel-Engine Div., General Motors Corp., in a paper on Automotive Two-Cycle Diesel Engines—and the comparison should therefore be based on the heavy-duty engine. A comparison of American stock gasoline and Diesel engines of the four-cycle type, of between 200- and 700-cu. in. displacement, shows that the four-cycle Diesel engine is about 59 per cent heavier per unit of displacement, and 51 per cent heavier per horse power.

The two-cycle type commends itself as a means to bring down the specific weight of the Diesel engine to that of the conventional gasoline engine. With the same speed and b.m.e.p., the output of the engine would be doubled, and the specific weight therefore halved. Of course, scavenging air must be supplied, and this requires an outside blower. To give an idea of the increase in the specific weight due to this blower, Mr. Shoemaker included in his paper a table of specifications of blowers manufactured by General Motors Corporation, including three automotive sizes, with outputs of 943, 629.5, and 471.5 cu. ft. per min. respectively, when running at 3880 r.p.m. These blowers are suitable for engines of 165, 110, and 82.5 hp. respectively, at 2000 r.p.m. The specific weights of these blowers are

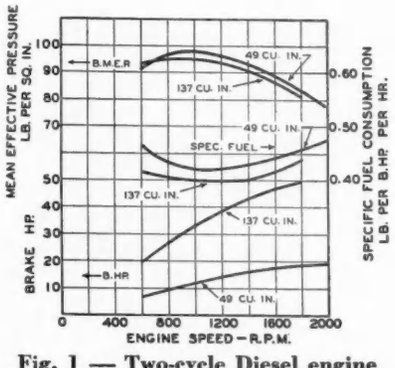

Fig. 1 — Two-cycle Diesel engine performance. Single cylinder uniflow type (Uncorrected dynamometer data. Blower driven by engine)

Operating Economy Diesel Design Fuel Rating

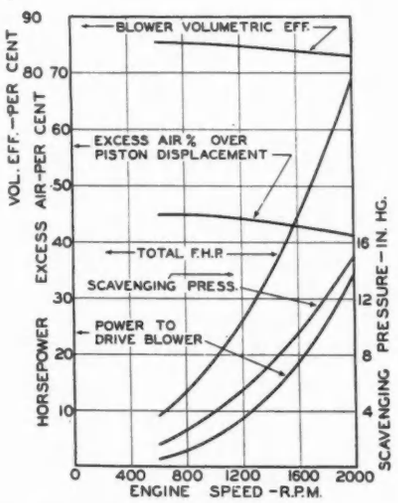

Fig. 2—General Motors two-cycle Diesel engine blower efficiency, required power and air consumption

0.364, 0.477, and 0.545 lb. per hp. when built of aluminum, and 0.568, 0.702, 0.755 lb. per hp. when built of cast iron. Thus, even when built of cast iron the blower should weigh considerably less than 1 lb. per hp. The two-cycle engine therefore should weigh approximately one-half as much per hp. as the four-cycle, plus about 1 lb. for the blower. Fig. 1 herewith shows the performance of two typical two-stroke uniflow Diesel engines of conventional design and material.

For scavenging, an excess of air of 35 to 45 per cent over the displacement has been found desirable, and this excess air ensures not only thorough scavenging, but also additional cylinder cooling. Fig. 2 gives the excess air delivered to an automotive type two-cycle engine, as determined by test.

A four-cycle engine breathes through one valve for about 240 deg. of crank rotation, while the two-cycle engine breathes through two valves for about 120 deg. Therefore, at any given speed of rotation, the velocities through the valves are the same, and the limiting rotational speed in general is the same for both engines. The two-cycle, pressure-scavenged engine has the further advantage of having the air supplied by a pressure blower which has a very large inlet passage and is not materially affected by speed, so that the volumetric efficiency is well sustained at high speed. (Fig. 2).

Fig. 4 shows a typical curve of scavenging pressure vs. speed, plotted on logarithmic co-ordinates. This shows that the pressure varies approximately as the square of the speed, and the engine can, therefore, be considered as a fixed orifice of an appropriate size. In a like manner, the leakage path of the displacement blower has the characteristic of a fixed orifice. Hence the air always will flow through the leakage paths and the engine in the same proportion, and the volumetric efficiency of the blower-scavenged, two-cycle engine is, therefore, practically constant over the entire speed range.

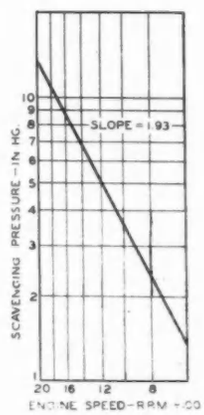

Fig. 4—Scavenging pressure versus engine speed on a blower scavenged two-cycle Diesel engine

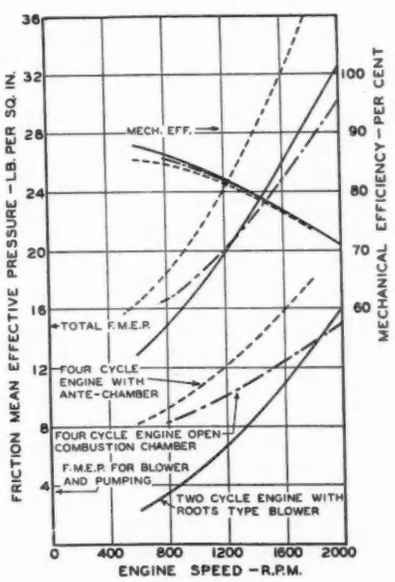

Fig. 3 — Mechanical efficiency, friction and pumping losses of typical two and four-cycle Diesel engines

The maximum speed is limited only by the permissible scavenging power loss.

Fig. 3 shows the mechanical efficiency, friction, and pumping losses of two representative modern four-cycle Diesel engines, and of a similar two-cycle engine. The mechanical efficiency of the two-cycle is slightly above that of either of the four-cycle engines. In the two-cycle engine, about one-half of the total friction loss is required for the supply of scavenge air.

Offhand, it would appear that for optimum scavenging the exhaust back pressure should be as low as possible, and that extremely large exhaust pipes and mufflers would be required, as is common practice in large staionary installations. It should be borne in mind, however, that in high-output engines the function of the blower is to get air into

the cylinder, and any excess that is blown into the exhaust is largely wasted, except for cooling effects where badly needed. It has been found that with proper port and valve timing, the power and economy are actually slightly improved by a

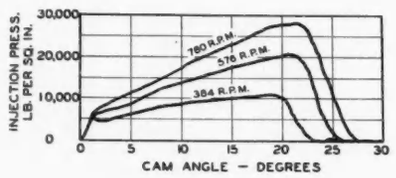

Fig. 5—Injection pressures during period of injection.

reasonable exhaust back pressure, and that mufflers of conventional design and capacity are quite satisfactory. Silencing of the exhaust has been found to be no more difficult than with conventional commercial engines.

One of the most common objections advanced against the high-speed Roots-type blower has been the annoying noise of the air inlet. An analysis of the air flow into such a blower with straight cycloidal rotors shows the displacement to vary in a most abrupt manner, causing violent pressure waves to be set up in the inlet and outlet. By modifying the cycloidal form and making the rotor lobes helical instead of straight, the inlet flow can be made absolutely uniform, and the discharge greatly improved. From indicator diagrams taken in the inlets of two blowers, one equipped with straight two-lobed, the other with helical three-lobed rotors, the smoother pressure characteristics of the latter are said to be evident. Very satisfactory silencing can be obtained with conventional intake silencers or air cleaners.

With normal piston design, the amount of heat liberated above the piston requires such a steep temperature gradient from the piston crown to the cylinder wall that the ring belt, which lies in this path, operates at a temperature above the critical point of ordinary lubricating oils, and ring sticking is likely to result. Piston materials of higher thermal conductivity do not eliminate this trouble. Investigation of the temperature gradient by means of fusible plugs and by thermocouples in engines under operating conditions, indicated that the heat path could be effectively blocked off by coring out the rim of the piston between the piston crown and the ring belt, and cooling the crown directly by an oil spray. This keeps the ring belt well below the coking or gumming temperature of ordinary oils, and so lowers the skirt temperature that the usual taper is not necessary.

Since the piston-inertia loads in a two-cycle engine reduce the maximum bearing loads, an iron piston can be used to advantage.

The pressure in the cylinder is a definite function of the rate of combustion, and in the final analysis depends on the characteristic of the injection cam. Now, if the engine is to operate over a wide speed and load-range, the rate of fuel delivery into the cylinder may need to vary within limits of 6 or 8 to 1. With fixed-area spray orifices, this requires a variation in pressure of about 40 or 60 to 1, and, for proper atomization at low speed, the pressures at high speed are likely to be 15,000 to 20,000 lb. per sq. in. Considering the fact that fuel oil is at least 100 times more elastic than steel, it is obvious that there must be more steel than fuel oil between the pump delivery valve and the nozzle valve. Hence, a unit injector is used, with the pump plunger close to the spray orifices. The simple spring-loaded discharge valve can be used to advantage when there are no high pressure waves in the fuel-supply lines.

The three curves in Fig. 5 show the pressure at the spray nozzle of a somewhat larger unit injector with a differential needle valve. The pressures were measured with a carbon-stack electrical indicator having a 1/16-in. piston in the nozzle itself, each card being the composite of five or six successive injections. It is also noteworthy that the pressure and, hence, the time rate of discharge, increases as the injection proceeds, and that there are neither pressure waves nor secondary injections even at as low a speed as 384 r.p.m.

Part-Load Economy

FACTORS controlling part-load economy were discussed in a paper by Hector Rabezzana of A.C. Spark-Plug Division. One of the reasons for low part-load economy is unequal mixture distribution, which latter is aggravated by the use of large-sized manifolds in conjunction with downdraft carburetors for the purpose of increasing the power output of the engine. Mr. Rabezzana ventured the opinion that the next move would be a compromise between economy and maximum output, and that smaller manifolds would be used. Turbulence of the incoming charge tends to make the mixture more nearly homogeneous. Stratification of the mixture tends to lower economy. It can be reduced or prevented by improving the design of the manifolding, by using a blower between the carburetor and the cylinders, or by using mechanical mixers. Dilution of the combustible charge is due to overlapping of the valve periods, which allows burnt gases to be drawn into the inlet manifold. Charts accompanying the paper showed how the fuel mileage can be increased by eliminating valve overlap and by reducing the exhaust back pressure. The author expressed the view that it should not be difficult to develop a variable valve-timing system that would be right for all speeds.

The reason stratification and dilution decrease the fuel mileage is that they interfere with ignition of the charge. Ignition conditions can be improved by providing good scavenging around the plugs, as by using smaller plugs, with small dead space between the insulator and the shell, and by so locating the plugs that the incoming gases have a chance to sweep the burnt gases from the vicinity.

Lengthening the spark gaps helps with ignition of the mixture, but long gaps reduce the periods between "regappings" as well as the period in which the insulator becomes incrusted. Combustion deposits on the spark-plug insulators may cause periodic missing of cylinders at high speeds when the plugs are very hot, which results in a loss of maximum speed and in fuel mileage. This fault can be remedied by the use of cooler plugs. Long high-tension ignition leads result in a loss of spark energy and in many cases in misfiring or cross-firing, due to the transfer of electric energy from one cable to another. Mr. Rabezzana's cure for such capacity losses is to install the distributor at the center of the cylinder block and drive it by a flexible shaft. The coil could be included in the same casing with the distributor head, which would eliminate a secondary lead from the coil to the distributor. This type of distributor drive permits of installing the breaker points on the crankshaft, which would prevent "wandering" of the ignition timing due to flexibility in engine parts. Owing to this "wandering," the spark advance must be

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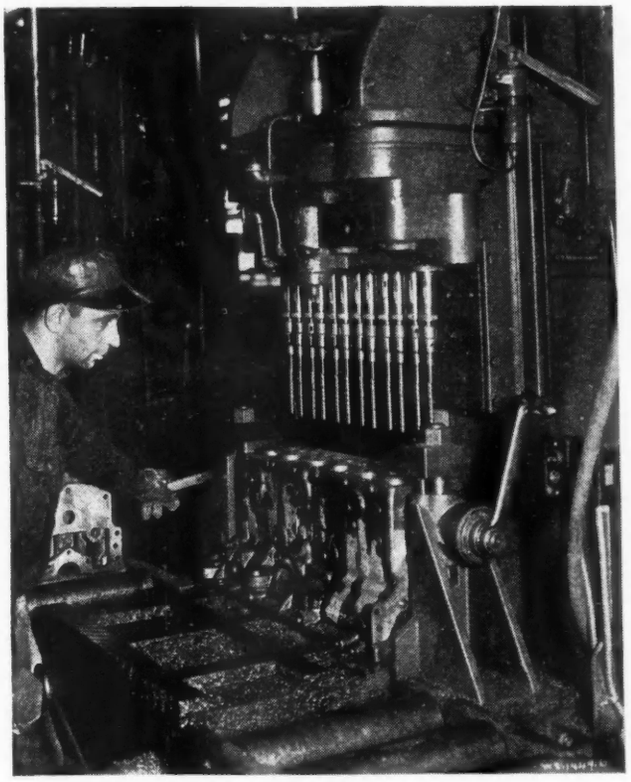


Multiple drill machines of the DeSoto cylinder block line. This new equipment is drilling valve stem guides and tappet holes.

Production Lines

On Measurement

Inside glimpse of design and manufacture of precision instruments and meters is afforded by a 32-page brochure, "When You Can Measure," recently issued by the General Electric Co. It's a fascinating story of how instruments are designed, calibrated, and built within a truly scientific atmosphere. Research men will be interested in the brief comments on the calibration of standards for resistance, current, voltage, time and temperature. We'll be glad to get you a copy.

Diesel Dope

A sizable paper cover book on Diesel Operation stressing the role of fuels and lubricants has been published by The Texas Company. It contains an introductory section on the Diesel engine with a comparison of Diesel and gasoline cycles. Bulk of discussion is aimed at fuels and lubricants for Diesel engines of various sizes and various kinds of operation. Sections of the book deal with following subjects — physical properties of lubes, essentials of bearing lubrication, cylinder lubrication, selection of lubricants, physical properties of Diesel fuels, selection of Diesel fuels. All in all the book represents a very comprehensive, if condensed, summary of the factors contributing to the correct operation of the modern high speed Diesel engine. We commend it to Diesel designers as well as to fleet operators. We'll be glad to get you a copy.

Eye Appeal

Every now and then we have occasion to discuss the matter of eye-appeal in the design of machine tools. Manufacturers sometimes wonder whether it's worth while spending extra money for good looking forms, better attention to fine details of appearance, and good paint. Authoritative answer is given in a recent address by Chrysler's D. A. Wallace, at the convention of the Associated Machine Tool Dealers of America at Dearborn Inn. Wallace says that eye-appeal is one of the most important details of a machine tool. Psychologically it promotes better workmanship, better care of the machine, and better shop housekeeping. He believes that the surface has been barely scratched in this direction. Moreover, it is a fact that all large producers consider their plants as show places and want machine shops to look as good to the public as do some of the better motor car show rooms.

Relativity and Quanta

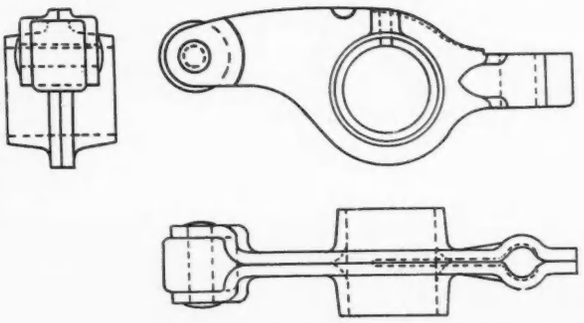
Not in many years has there been as exciting an event as the popularization of the philosophy of modern physics from the pen of Albert Einstein. Certainly no one is better qualified to explain relativity than the father of the theory. What we are leading up to is that the book—"The Evolution of Physics" by Albert Einstein and Leopold Infield is a magnificent account of the growth of natural science from its dim beginnings, written for the layman but of more than passing significance to any engineer or research worker. It tells of the rise and decline of mechanistic conceptions—the evolution of the special relativity theory—development of the grand general relativity theory—and finally, the evolution of the theory of quanta of mass and energy. Written simply and beautifully, the book will give you an illuminating perspective of the natural sciences with an inkling of possible developments of the future.

Welded Strength

Many new things are in store by way of developments in leaf spring design. Troublesome detail has been the weakness of the top leaf of chassis springs. We note that one phase of development, in an experimental stage, is a design in which the wrapped eye is welded to the top of the leaf, by means of a heavy weld bead laid on with the electric arc. When the bead is heat treated, in the process of treating the entire leaf, the resulting bond is stronger than the parent metal. On heavy duty truck service this device put an end to top leaf breakage.—J. G.

Allis-Chalmers Adopts Pressed Steel Rocker Arm

In replacing the time honored drop forged rocker arm in their latest tractor engine with one of pressed steel, Allis-Chalmers blazes a new trail. Construction details are shown in the sketch



Part Load Economy

(Continued from page 852)

held down below what it should be for maximum economy. From a chart accompanying the paper it could be seen that in the particular case to which it applied, there was as much variation as 10 deg. in the spark timing from cycle to cycle under otherwise identical conditions, the greatest variations occurring at a critical speed of resonance of the engine.

In the past, automobile engineers have held to the opinion that in development work one change should be made at a time, and the results obtained should decide whether the change was worth while or not. It is Mr. Rabezzana's view that this method no longer suits the conditions, because at the present state of automobile development, any single change, as a rule, can bring only very little improvement and would generally be regarded as not justifying risks involved in making it; but if several changes are made at the same time, all based on sound reasoning, the resultant improvement is likely to be very apparent.

Diesel Fuel in Flame Cuts Lag Only Moderately

(Continued from page 848)

the total delay for fuels of normal volatility. Rothrock and Waldron have shown fuel sprays to dissolve in 1 to 2 milliseconds even before ignition, and in the flame, therefore, evaporation must be almost instantaneous. This means that the roughly 1 millisecond ignition lag while injecting into flame is almost entirely of chemical nature, and the presence of flame does not accelerate the chemical reactions in the adjacent mixture about to ignite.

There is no reason to believe that the conditions in a single spray differ in this respect from those found in double injection. Thinking of the ignition lag in terms of individual fuel droplets, we can visualize combustion as droplets igniting with successively shorter lags, and the droplets that are injected into hot flame approach the minimum ignition lag, which is in the order of 1 millisecond. Although this view tempts to interesting speculations on the combustion process in Diesel engines, the complexity of the process imposes caution in drawing conclusions without experimental backing up at every step.

A New Alloy of Great Density

A NEW commercial alloy of greater density than any previously known was mentioned in a paper on New Materials read before the London Branch of the Institute of Physics by E.A.G. Liddiard of the British Non-Ferrous Metals Research Association. It is prepared by mixing tungsten powder with small proportions of copper and nickel powder and heating the mixture while under pressure to a temperature above the melting points of copper and nickel. In this way a sintered alloy is obtained which has a specific gravity of 16.5, as compared with 11.34 for lead. The new material has been found useful in radio therapy, because it is less penetrable to X-rays and radium emanations than lead. Whether it will find application in the automotive and allied industries remains to be seen, because the demand is more for light than for heavy materials, and, besides, an alloy of tungsten, nickel and copper cannot be cheap. But unusual materials problems sometimes arise, and it is well to know that a commercial material of this high specific gravity is available.

BUYERS' GUIDE

Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on page 36

This Advertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

Acid, Sulphuric
New Jersey Zinc Co.

Air Valves, Punch Press
F. J. Littell Machine Co.

Alloys
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Ferro
New Jersey Zinc Co.
Non-Ferrous
Dow Chemical Co. (Magnesium)
New Jersey Zinc Co.

Arms & Knuckles, Steering
Atlas Drop Forge Co.
Park Drop Forge Co.

Auto Body Panels
Metal Auto Parts Co., Inc.

Axles
Atlas Drop Forge Co.
Park Drop Forge Co.
Union Drawn Steel Co. (Cold Drawn)

Bearings
Roller
Timken Roller Bearing Co. (Tapered)

Belting, Metal Conveyor, High & Low Temperature
Wickwire Spencer Steel Co.

Blanks
Forged
Atlas Drop Forge Co.
Park Drop Forge Co.
Wyman-Gordon Co.

Boring Machines
Baker Brothers, Inc.

Brakes, Electric
Clark Controller Co.

Brake Strand
Wickwire Spencer Steel Co.

Camshafts
Atlas Drop Forge Co.
Park Drop Forge Co.

Castings
Steel
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary

Channels for Glass
Felt
American Felt Co.

Connecting Rods
Atlas Drop Forge Co.
Wyman-Gordon Co.

Controllers, Electric Motor
Clark Controller Co.

Cowls
Metal Auto Parts Co., Inc.

Crankshafts
Atlas Drop Forge Co.
Park Drop Forge Co.
Union Drawn Steel Co.
Wyman-Gordon Co.

Cutters
Baker Brothers, Inc. (Keyseating)

Drilling Machines
Baker Brothers, Inc.

Drop Forgings
Atlas Drop Forge Co.
Park Drop Forge Co.

Dust Shields
Metal Auto Parts Co., Inc.

Feeds, Roll for Punch Presses
F. J. Littell Machine Co.

Felt
American Felt Co.

(Turn to page 34, please)

BUYERS' GUIDE *(Continued from page 33)*

Fenders
Metal Auto Parts Co., Inc.

Forgings
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Wyman-Gordon Co.

Furnaces
Electric
American Bridge Co., U. S. Steel Corp. Subsidiary

Gaskets
Felt
American Felt Co.

Grease Seals & Retainers
Chicago Rawhide Mfg. Co.

Heat Treating
Barnes Co. Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.

Hoods
Metal Auto Parts Co., Inc.

Instrument Panels
Metal Auto Parts Co., Inc.

Keyseaters
Baker Brothers, Inc.

Lathes
Automatic Chucking
Potter & Johnston Machine Co.
Turret
Potter & Johnston Machine Co.

Leather Goods, Mechanical
Chicago Rawhide Mfg. Co.

Leather Parts, Boots & Straps
Chicago Rawhide Mfg. Co.

Machines
Straightening, for Punch Presses
F. J. Littell Machine Co.

Milling Machines
Potter & Johnston Machine Co.

Molding Material (Powder)
E. I. du Pont de Nemours & Co., Inc., Plastic Dept., Industrial Division

Motor Pans
Metal Auto Parts Co., Inc.

Packings
Leather
Chicago Rawhide Mfg. Co.

Pads
Felt
American Felt Co.

Perforated Metal
Wickwire Spencer Steel Co.

Plastic Materials
Sheets, Rods & Tubes
E. I. du Pont de Nemours & Co., Inc., Plastic Dept., Industrial Division

Plating, Cadmium
Parker Rust Proof Co.

Punch Press Feeds
F. J. Littell Machine Co.

Radiator Shields
Metal Auto Parts Co., Inc.

Reels, Automatic Centering (Coil Stock)
F. J. Littell Machine Co.

Refrigerator Stampings
Metal Auto Parts Co., Inc.

Running Boards
Metal Auto Parts Co., Inc.

Running Board Shields
Metal Auto Parts Co., Inc.

Rust Proofing
Parker Rust Proof Co.

Screens, Woven Wire
Wickwire Spencer Steel Co.

Screw Machine Products
Barnes Co., Wallace, Div. of Associated Spring Corp.

Screw Machines
Potter & Johnston Machine Co.

Seals
Oil & Grease
Chicago Rawhide Mfg. Co.

Shafting
Bliss & Laughlin, Inc.
Jones & Laughlin Steel Corp. (Turned & Polished, Turned & Ground, Cold Drawn)
Union Drawn Steel Co.

Shafts, Axles, Propeller and Transmission
Mechanics Universal Joint (Division Borg-Warner Corp.)

Special Machinery
Baker Brothers, Inc.

Springs
Extension, Compression, Torsion or Flat
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Jones & Laughlin Steel Corp.
Raymond Mfg. Co., Div. of Associated Spring Corp.
Wickwire Spencer Steel Co.

Stampings, or Drawings, Metal
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Raymond Mfg. Co., Div. of Associated Spring Corp.
Worcester Stamped Metal Co.

Stands, Reel (Coil Stock)
F. J. Littell Machine Co.

Starters, Motor (for factories)
Clark Controller Co.

U. S. Quota Upped 1600 Cars By Czechoslovakian Pact

The quota on American motor vehicles was increased to 1600 units per year and duties decreased under the terms of the United States-Czechoslovakian trade agreement signed Monday night in Washington. Duties on replacement parts also were reduced.

The increased quota, the State Department said, is nearly as large as the greatest annual importation from the United States in pre-depression years when permits were issued much more freely than in recent years.

In order to facilitate the utilization of the increased quota for motor vehicles, the duty on passenger automobiles weighing over 1000 kilos (2205 lb.) was reduced from 43 to 27 cents per lb. and on truck chassis weighing under 1500 kilos (3307 lb.) from 30 also to 27 cents per lb., provided the automobiles and chassis are imported complete with all their normal equipment. The truck bodies are made in Czechoslovakia.

Automobile replacement parts not specifically provided for in the tariff will also benefit by the same reduction.

BUYERS' GUIDE

Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on page 44

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Air Valves, Punch Press
F. J. Littell Machine Co.

Alloys
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Ferro
International Nickel Co.
Non-Ferrous
Dow Chemical Co. (Magnesium)
International Nickel Co.

Arms & Knuckles, Steering
Atlas Drop Forge Co.

Auto Body Panels
Metal Auto Parts Co., Inc.

Axles
Atlas Drop Forge Co.
Spicer Mfg. Corp.
Union Drawn Steel Co. (Cold Drawn)

Bearings
Ball
Aetna Ball Bearing Mfg. Co.
Clutch Release
Aetna Ball Bearing Mfg. Co.
Roller
Aetna Ball Bearing Mfg. Co.

Belting
Metal, Conveyor, High & Low Temperature
Wickwire Spencer Steel Co.

Blanks
Forged
Atlas Drop Forge Co.
Wyman-Gordon Co.

Bolts & Nuts
National Screw & Mfg. Co.

Boring Machines
Bullard Co.

Brake Strand
Wickwire Spencer Steel Co.

Camshafts
Atlas Drop Forge Co.

Castings
Steel
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary

Channels for Glass
Felt
American Felt Co.

Clamps, Hose (Adjustable)
Wittek Mfg. Co.

Cleaners, Metal
Pennsylvania Salt Mfg. Co.

Clutches, Automatic
Spicer Mfg. Corp.

Connecting Rods
Atlas Drop Forge Co.
Wyman-Gordon Co.

Cotter Pins
National Screw & Mfg. Co.

Cowls
Metal Auto Parts Co., Inc.

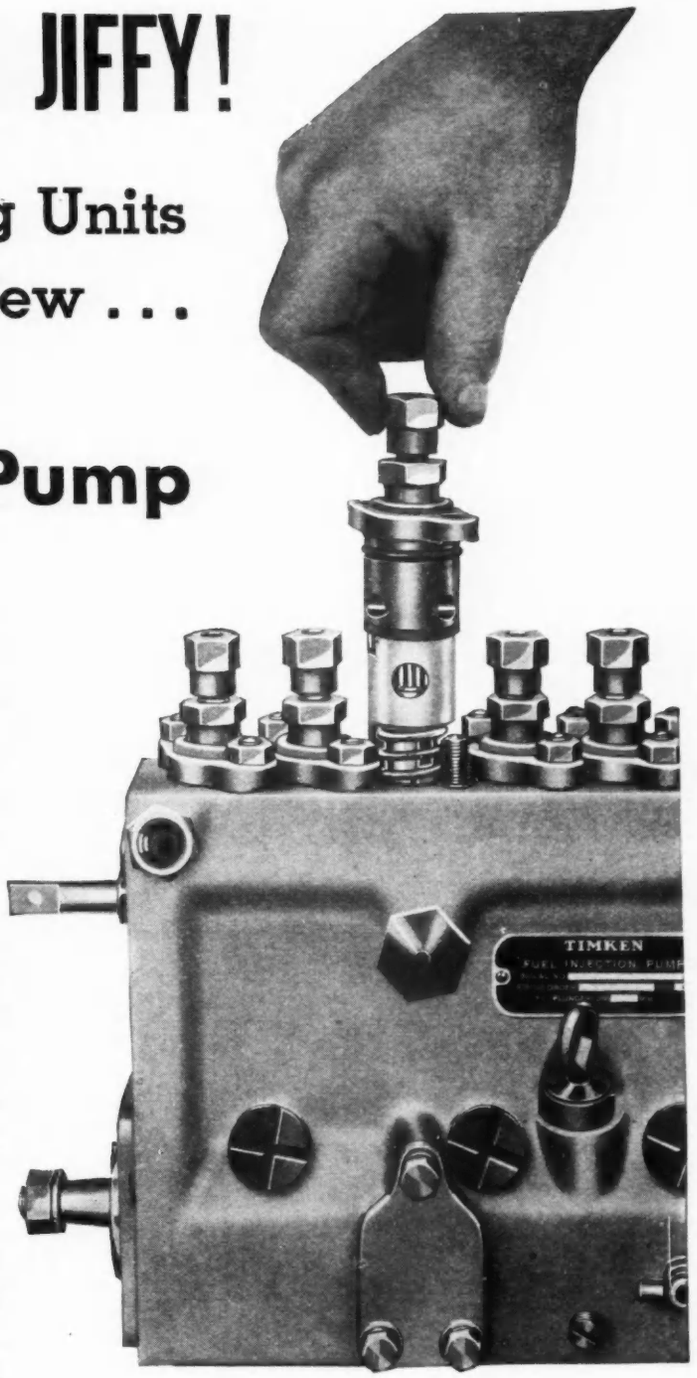
Crankshafts
Atlas Drop Forge Co.
Union Drawn Steel Co.
Wyman-Gordon Co.

Cutting Oils
Standard Oil Co. of Ind.

(*Turn to page 40, please*)

OUT AND IN IN A JIFFY!

Renewable Pumping Units Save Time In The New . . . TIMKEN Fuel Injection Pump



TIMKEN Fuel Injection Equipment now not only gives the compression-ignition engine operator superior performance and greater economy. It assures him against prolonged operating delays as well . . . through a new feature . . . *renewable pumping units.*

This great advancement makes it very rarely necessary to remove the TIMKEN Fuel Injection Pump from the engine. By keeping a spare set of pumping units on hand the operator is able to maintain the pump in tip-top condition with little or no time off the job.

When necessary, any individual pumping unit can be renewed as easily as a spark plug can be changed in a gasoline engine. Simply remove two small nuts, slip out the old unit, slip in the new one, replace the nuts. It is impossible to put it in the wrong way.

TIMKEN Fuel Injection Equipment—including pump, governor, timer and nozzles, all of the highest quality and precision—is a product of an All-American company which has become one of the world's most famous engineering-manufacturing institutions. When writing for further information mention the make, model and horsepower of your engine.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN
FUEL INJECTION EQUIPMENT

Automotive Men to Appear at Canadian Tariff Hearing

The State Department's Committee on Reciprocity Information has scheduled public hearings beginning April 4 to receive suggestions regarding the individual commodities on which it is considering granting tariff concessions under a broadened trade agreement with Canada.

Scheduled to appear before the committee on April 7 are C. M. Dinkins, of the Industrial Truck Statistical Association, Washington, who will direct his testimony on possible tariff reductions on tractors and trucks; and a representative of the Diesel Engine Manufacturers' Association, of New York City, on the subject of Diesel engine tariff concesions.

Floyd F. Corcoran

Floyd F. Corcoran, personnel director of the Flint division of the Chevrolet Motor Co. division of General Motors, died March 24 of nephritis resulting from a throat infection. Although only 33, Mr. Corcoran had been employed at Chevrolet since 1920 and was widely known throughout the corporation for his personnel activities.

BUYERS' GUIDE

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See Alphabetical List of Advertisers on page 47

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Air Valve, Punch Press
F. J. Littell Machine Co.
Alloys
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Non-Ferrous (Magnesium)
Dow Chemical Co.
Arms & Knuckles, Steering
Park Drop Forge Co.
Auto Body Panels
Metal Auto Parts Co., Inc.
Axles
Park Drop Forge Co.
Union Drawn Steel Co. (Cold Drawn)
Balls, Steel
Strom Steel Ball Co.
Bearings
Ball
Federal Bearings Co., Inc.
S.K.F. Industries, Inc.
Needle
Torrington Co.
Roller
S.K.F. Industries, Inc.
Timken Roller Bearing Co. (Tapered)
Thrust
S.K.F. Industries, Inc.
Belting (Metal, Conveyor, High & Low Temperature)
Wickwire Spencer Steel Co.
Blanks
Park Drop Forge Co.
Wyman-Gordon Co.
Boring Machines
Greenlee Brothers & Co.
Brakes
Emergency
American Cable Div., American Chain & Cable Co., Inc. (Automotive Division)
Hydraulic
Bendix Products Corp.
Mechanical
Bendix Products Corp.
Power
Bendix Products Corp.
Brake Strand
Wickwire Spencer Steel Co.
Brake Testers
Bendix Products Corp.
Broaches
Colonial Broach Co.
Broaching Machines
Colonial Broach Co.
Broach Sharpening Machines
Colonial Broach Co.
Bushings
Drill & Jig
Colonial Broach Co.
Steel
Danly Machine Specialties, Inc.
Camshafts
Park Drop Forge Co.
Carburetors
Bendix Products Corp.
Castings
Steel
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Chains
Tire
American Cable Div. American Chain & Cable Co., Inc. (Automotive Division)
Channels for Glass
Felt
American Felt Co.
Western Felt Works
Clamps
Danly Machine Specialties, Inc.
Connecting Rods
Park Drop Forge Co.
Wyman-Gordon Co.
Controls
Choke (Automatic)
Bendix Products Corp.
Clutch (Automatic)
Bendix Products Corp.
Contour Sawing Machines
Continental Machine Specialties, Inc.
Couplings, Pipe & Tubing
Dole Valve Co.
Cowls
Metal Auto Parts Co., Inc.
Crankshafts
Park Drop Forge Co.
Union Drawn Steel Co.
Wyman-Gordon Co.
Cutters
Milling
Barber-Colman Co.
Deflectors, Draft
Dole Valve Co.
Die Making Machines
Continental Machine Specialties, Inc.
Die Sets, Precision
Danly Machine Specialties, Inc.

AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

JUNE 25, 1938

LOOKS LIKE ANOTHER PLACE FOR NEOPRENE

JUNIOR DESIGNER:
"Same as we're using in dust seals and oil pump gaskets?"

SENIOR DESIGNER:
"You bet. Neoprene stands up in all the tough spots."

Make that part better with

NEOPRENE

CHLOROPRENE RUBBER MADE BY DU PONT

•

Consult your rubber supplier or write us

CONVERSATIONS like the above are taking place in design departments all over the country right now. Automotive designers are counting heavily on neoprene for 1939 cars . . . because neoprene successfully solved more than forty problems on 1938 models.

Neoprene is now being used in tappet seals, oil pump gaskets, automatic shift hose linings, horn and ignition cable, radiator cap gaskets . . . and in dozens of other places where other materials have failed.

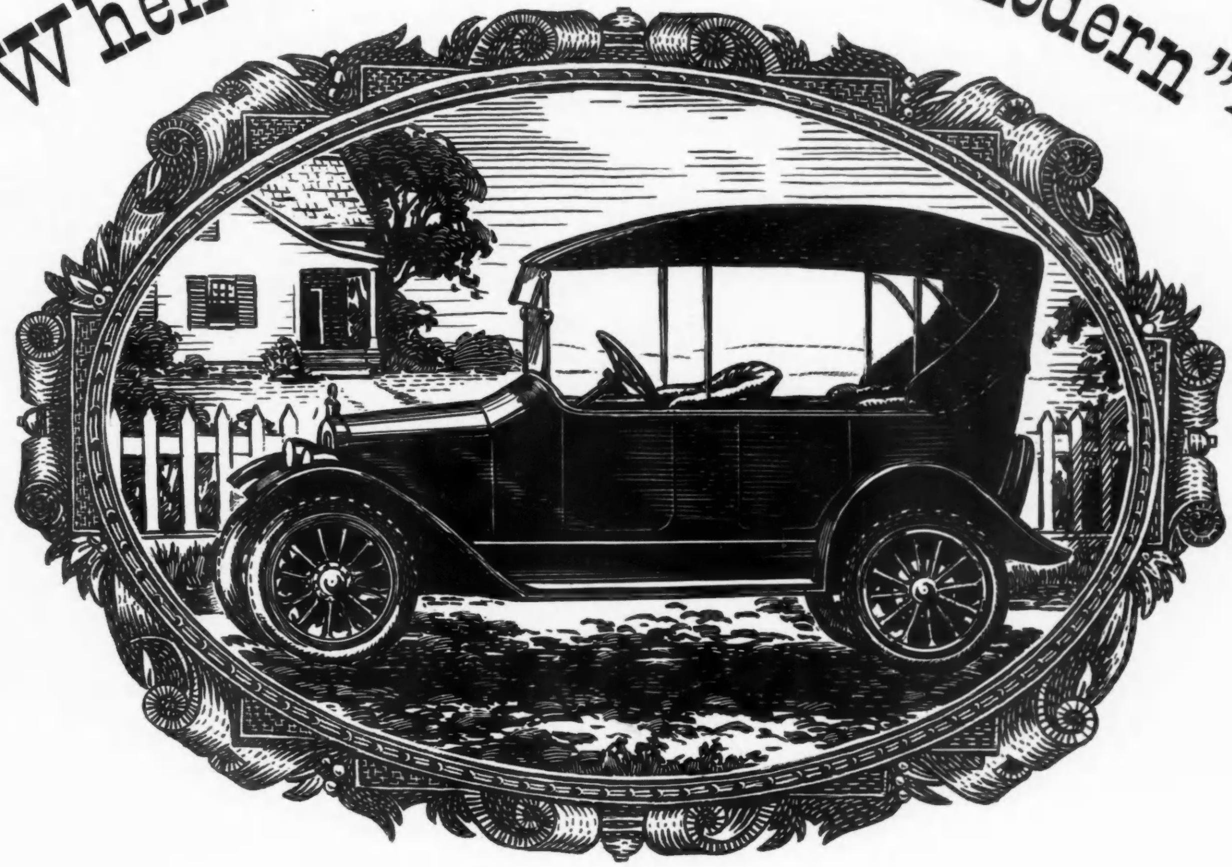
Why this swing toward a comparatively new material? Because automotive engineers have found that neoprene stands up where other materials fall down. Neoprene makes better parts. And better parts make better cars.

Neoprene has all the best features of rubber . . . resilience, strength, toughness . . . *plus* resistance to oils, gasoline, heat and sunlight. Doesn't this suggest many profitable ways you can use neoprene too?

DU PONT
REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., INC., RUBBER CHEMICALS DIVISION, WILMINGTON, DELAWARE

When Maxwells Were "Modern"—



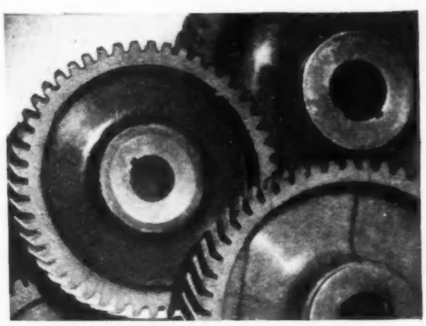
Bakelite Laminated Silent Gears Were Veterans

EVEN IN THE DAYS when "torpedo" bodies and muffler cut-outs were the rage, Bakelite Laminated was an accepted, time-proved standard for silent timing gears.

At that time, this material already had been highly developed through creative research which started in 1905 with Dr. L. H. Baekeland's original experiments in phenolic resin chemistry.

Today, continued research is contributing refinements and improvements that constantly maintain the quality leadership of Bakelite Laminated timing gears.

Tough, wear-resistant and lastingly accurate, Bakelite Laminated gears increase the dependability of thousands of modern cars. On production lines, their high uniformity saves rejections. Write for informative new booklet 10L, "Bakelite Laminated".



Silent gears that resist heat, oil, wear and moisture. Standard equipment in thousands of 1938 cars.

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.

BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Canada *West Coast:* Electrical Specialty Co., Inc., Los Angeles and San Francisco, Cal.

BAKELITE

PLASTICS HEADQUARTERS

BUYERS' GUIDE

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Air Valve, Punch Press
F. J. Littell Machine Co.

Alloys
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Non-Ferrous (Magnesium)
Dow Chemical Co.

Arms & Knuckles, Steering
Atlas Drop Forge Co.

Auto Body Panels
Metal Auto Parts Co., Inc.

Axles
Atlas Drop Forge Co.
Union Drawn Steel Co. (Cold Drawn)

Belting (Metal, Conveyor, High & Low Temperature)
Wickwire Spencer Steel Co.

Blanks
Atlas Drop Forge Co.
Wyman-Gordon Co. (Forged)

Boring Machines
Greenlee Brothers & Co.

Brakes
Hydraulic
Bendix Products Corp.
Mechanical
Bendix Products Corp.
Power
Bendix Products Corp.

Brake Strand
Wickwire Spencer Steel Co.

Brake Testers
Bendix Products Corp.

Camshafts
Atlas Drop Forge Co.

Carburetors
Bendix Products Corp.

Castings
Steel
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary

Chains
Bead
The Bead Chain Mfg. Co.
Tire
American Chain Div. American Chain & Cable Co., Inc. (Automotive Division)

Channels for Glass
Felt
American Felt Co.

Connecting Rods
Atlas Drop Forge Co.
Wyman-Gordon Co.

Controls
Choke (Automatic)
Bendix Products Corp.
Clutch (Automatic)
Bendix Products Corp.

Couplings, Pipe & Tubing
Dolve Valve Co.

Cowls
Metal Auto Parts Co., Inc.

Crankshafts
Atlas Drop Forge Co.
Union Drawn Steel Co.
Wyman-Gordon Co.

Deflectors
Dolve Valve Co.

Drilling Machines
Greenlee Brothers & Co.

Drives
Bendix Products Corp.

Drop Forgings
Atlas Drop Forge Co.

Dust Shields
Metal Auto Parts Co., Inc.

Enamels
Bakelite Corp.

Feeds, Roll for Punch Presses
F. J. Littell Machine Co.

BUYERS' GUIDE—Continued

Felt
American Felt Co.

Fenders
Metal Auto Parts Co., Inc.

Forgings
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Wyman-Gordon Co.

Furnaces, Electric
American Bridge Co., U. S. Steel Corp. Subsidiary

Gaskets
Felt
American Felt Co.

Gear Material (Non-Metallic)
Bakelite Corp.

Heat Treating
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.

Hoods
Metal Auto Parts Co., Inc.

Hotels
Wellington Hotel

Instrument Panels
Metal Auto Parts Co., Inc.

Insulating Material
Bakelite Corp.

Lathes
Automatic Chucking
Potter & Johnston Machine Co.
Turret
Potter & Johnston Machine Co.

Leather Goods, Mechanical
Chicago Rawhide Mfg. Co.

Leather Parts, Boots & Straps
Chicago Rawhide Mfg. Co.

Machines
Straightening for Punch Presses
F. J. Littell Machine Co.

Materials, Molding (Phenolic)
Bakelite Corp.

Metals, Thermostatic
Dolve Valve Co.

Milling Machines
Potter & Johnston Machine Co.

Molded or Machined Parts (Phenolic)
Bakelite Corp.

Motor Pans
Metal Auto Parts Co., Inc.

Nozzles, Air
F. J. Littell Machine Co.

Oils
Break In
Acheson Colloids Corp.
Lubricating
Acheson Colloids Corp.

Packings
Leather
Chicago Rawhide Mfg. Co.

Pads
Felt
American Felt Co.

Perforated Metal
Wickwire Spencer Steel Co.

Primers, Gasoline
Dolve Valve Co.

Punch Press Feeds
F. J. Littell Machine Co.

Radiator Shields
Metal Auto Parts Co., Inc.

Radio Remote Control
S. S. White Dental Mfg. Co.

Reels, Automatic Centering (Coil Stock)
F. J. Littell Machine Co.

Refrigerator Stampings
Metal Auto Parts Co., Inc.

Rubber Chemicals
E. I. du Pont de Nemours & Co., Inc., Rubber Chemicals Division

Running Boards
Metal Auto Parts Co., Inc.

Running Board Shields
Metal Auto Parts Co., Inc.

Screens, Woven Wire
Wickwire Spencer Steel Co.

Screw Machine Products
Barnes Co., Wallace, Div. of Associated Spring Corp.

Screw Machines
Greenlee Brothers & Co.
Potter & Johnston Machine Co.

Seals, Oil & Grease
Chicago Rawhide Mfg. Co.

Shafts & Casings, Flexible (Radio)
S. S. White Dental Mfg. Co.

Shafting
Bliss & Laughlin, Inc.
Jones & Laughlin Steel Corp. (Turned and Polished, Turned & Ground, Cold Drawn)
Union Drawn Steel Co.

Shafts, Axles, Propeller and Transmission
Mechanics Universal Joint (Division Borg-Warner Corp.)

Special Machinery
Greenlee Bros. & Co.

Springs
Extension, Compression, Torsion or Flat
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Jones & Laughlin Steel Corp.
Raymond Mfg. Co., Div. of Associated Spring Corp.
Wickwire Spencer Steel Co.

Stampings or Drawings, Metal
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Worcester Stamped Metal Co.

(Turn to page 34, please)

Stands, Reel (Coil Stock)
F. J. Littell Machine Co.

Starter Switches (Automatic)
Bendix Products Corp.

Steel

Alloys
Bliss & Laughlin, Inc.
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Bars
Bliss & Laughlin, Inc.
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Inland Steel Co.
Jones & Laughlin Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Billets
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Jones & Laughlin Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary

Carbon
Bliss & Laughlin, Inc.
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Jones & Laughlin Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Cold Drawn
American Steel & Wire Co., U. S. Steel Corp. Subsidiary
Bliss & Laughlin, Inc.
Jones & Laughlin Steel Corp.
Union Drawn Steel Co.

Electric Furnace
Bliss & Laughlin, Inc.
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Plates
Inland Steel Co.

Rails
Inland Steel Co.

Shapes
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Jones & Laughlin Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary

Sheets
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Inland Steel Co.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary

Spring
American Steel & Wire Co., U. S. Steel Corp. Subsidiary
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Union Drawn Steel Co.

Stainless
American Steel & Wire Co., U. S. Steel Corp. Subsidiary
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
National Tube Co., U. S. Steel Corp. Subsidiary
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Strip
Inland Steel Co.

Structural
Inland Steel Co.

Vanadium
Union Drawn Steel Co.

Tapping Machines
Greenlee Brothers & Co.

Thermostats
Dolve Valve Co.

Turret Machines, Automatic
Potter & Johnston Machine Co.

Universal Joints
Mechanics Universal Joint Co., Div. Borg-Warner Corp.

Varnishes
Bakelite Corp.

Washers

Felt
American Felt Co.

Wicks

Felt
American Felt Co.

Wire

Flat, Round, Square or Special Shapes
Barnes Co., Wallace, Div. of Associated Spring Corp.
Wickwire Spencer Steel Co.

Piano & Music
Wickwire Spencer Steel Co.

Spring
Barnes Co., Wallace, Div. of Associated Spring Corp.

Wire Cloth
Wickwire Spencer Steel Co.

Wire Rope
Wickwire Spencer Steel Co.

BUYERS' GUIDE *(Continued from page 33)*

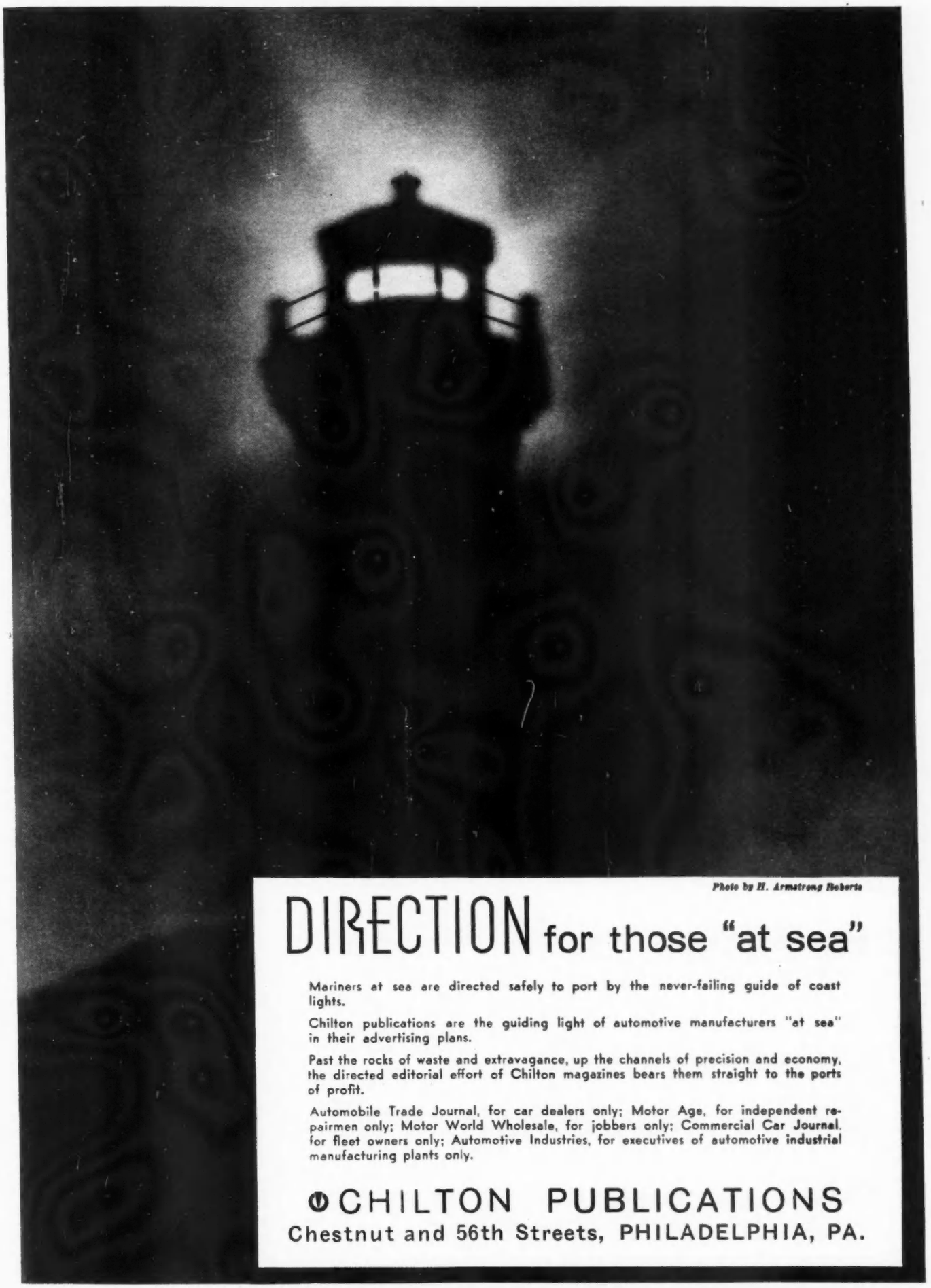

Photo by H. Armstrong Roberts

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Chilton publications are the guiding light of automotive manufacturers "at sea" in their advertising plans.

Past the rocks of waste and extravagance, up the channels of precision and economy, the directed editorial effort of Chilton magazines bears them straight to the ports of profit.

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Chestnut and 56th Streets, PHILADELPHIA, PA.

Index to Advertisers

This Advertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

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WHAT sort of automobile will the public buy? The answer, as we all know, begins this way: "A man will buy any automobile that he wants more than he wants the money it takes to buy it."

Your job—and Bendix' job is to help you—consists in building cars desirable enough to get themselves bought.

That means, of course, the car must be freshly, smartly styled. Trust your design department to come through on that.

It's the chassis that uses up the aspirin! How to make a car do everything it does quite a little better—*there's* a job that justifies your calling upon folks like Bendix for every bit of help they can provide! Carburetion, brake layout, gear shifting—any angle involving starting, running, handling, stopping—is a job where Bendix is thoroughly capable and cheerfully eager to pitch in and contribute.

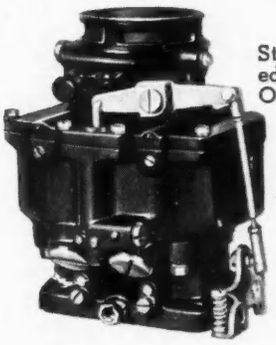
But you probably know from experience that Bendix is an ever-willing, reliable source of useful help. So, when the right moment comes—

Telephone

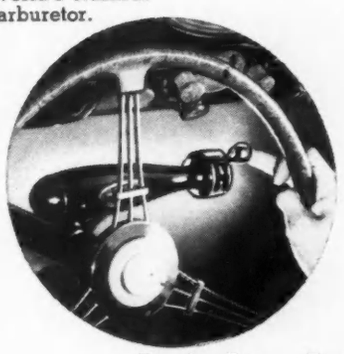
BENDIX

"South Bend 3-4141"

BENDIX PRODUCTS CORPORATION
(Subsidiary of Bendix Aviation Corporation)

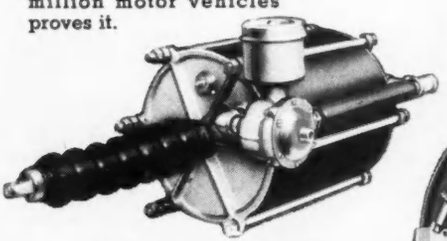


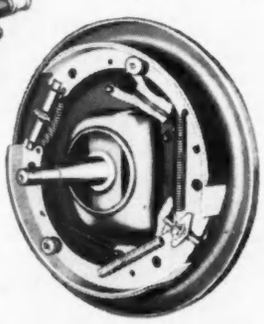
Stromberg—deservedly, World's Number One Carburetor.

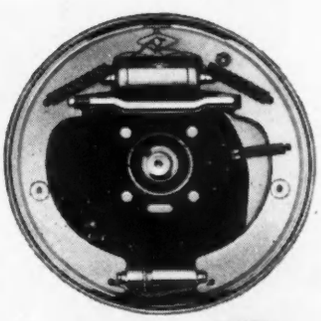


Bendix Finger-Tip Gear Control. First—most efficient—most complete. Also other types of automatic gear shifting.

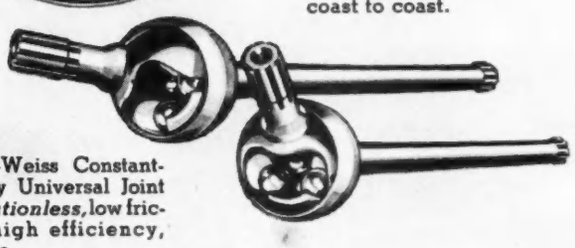
Bendix B-K Controlled Vacuum Power Braking—Finest Auxiliary braking known to the industry—performance on several million motor vehicles proves it.



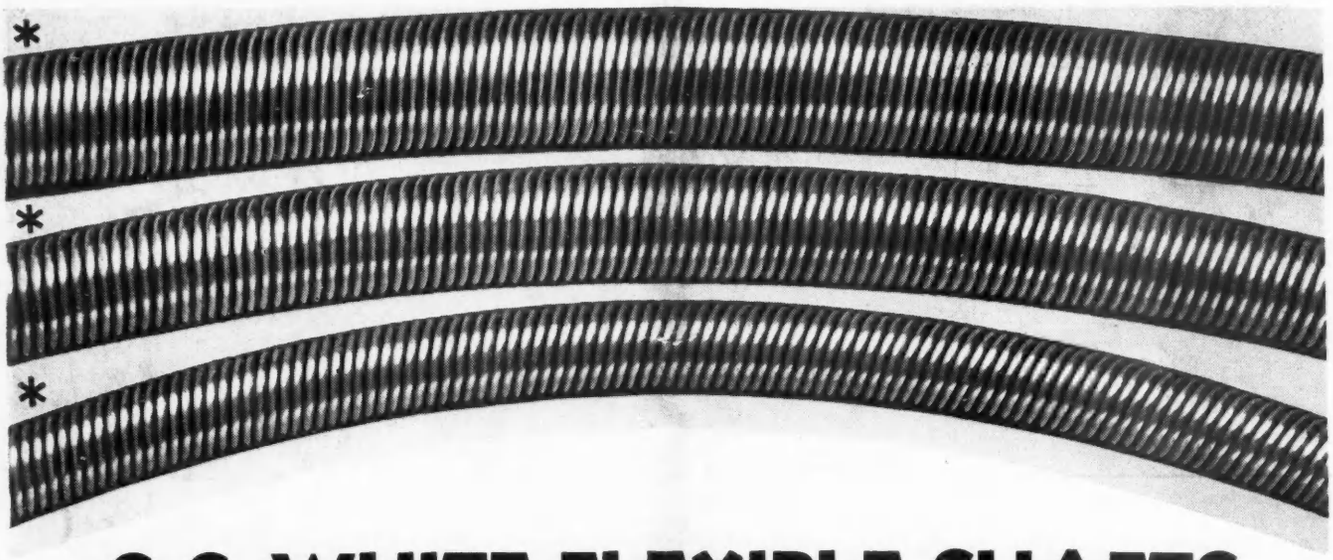




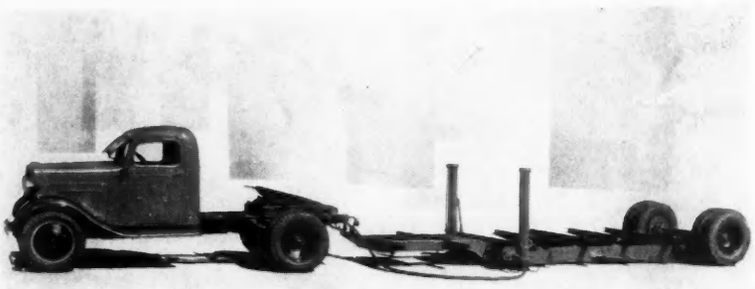
Bendix Brakes—Hydraulic and Mechanical—the most efficient of either type, with trained maintenance service available from coast to coast.



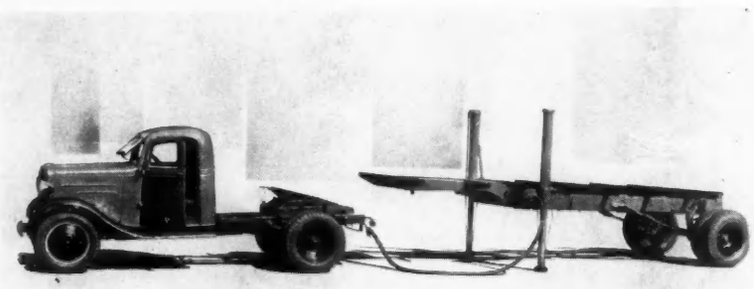
Bendix-Weiss Constant-Velocity Universal Joint—*Vibrationless*, low friction, high efficiency, long life.



S. S. WHITE FLEXIBLE SHAFTS
come in big sizes too . . .



Truck-Rail Freight Handling Device showing trailer chassis ready for raising, with .750" diam. flexible shaft connecting hydraulic pump to power take-off on draft vehicle.



Trailer chassis raised and supported on hydraulically operated pistons, ready for coupling to draft vehicle. After coupling, pistons are retracted.

* Top Shaft, 3/4" diam.; Middle Shaft, 5/8"; Bottom Shaft, 1/2"

There are now more than 20 different applications of S. S. White Power Drive and Remote Control flexible shafts in the automotive field. But most of them involve the use of shafts of comparatively small diameters.

To offset the possible impression that flexible shafts are available only in small sizes, may we point out that S. S. White Remote Control shafts are regularly made in diameters up to .437", and Power Drive shafts up to .750".

An example of the possibilities of larger diameter shafts, with their greater torque capacities, is furnished by the application illustrated. We will be glad to supply engineering data about the larger size shafts, and to cooperate in working out applications. Write us.

Send for a free copy of ENGINEERING BULLETIN 38 covering Flexible Shafts for Remote Control.

S. S. WHITE

The S. S. White Dental Mfg. Co.

INDUSTRIAL DIVISION

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